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DEPARTMENT OF THE INTERIOR, CANADA

HON. THOMAS G. MURPHY, Minister

ROY A. GIBSON, Assistant Deputy Minister

FOREST SERVICE

E. H. FINLAYSON, B.Sc. F., Director of Forestry

THE  
FORESTS OF CANADA

*Their Extent, Character, Ownership,  
Management, Products, and  
Probable Future*

(Revised for the Fourth British Empire Forestry Conference held in  
South Africa, September, 1935)



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**CORRIGENDA**

Page 13, line 6. The last two sentences of this paragraph should read:—

“ The total stand is now estimated to be about 273,657 million cubic feet, and the accessible stand 170,141 million cubic feet, of which 133,288 million cubic feet is softwood and 36,853 million feet is hardwood.”


Page 48, last paragraph, line 2: “ has averaged 226 million cubic feet ” should read “ has averaged 261 million cubic feet ”.

Page 60, paragraph 4, line 5: “ through fire is still some 263 million feet ” should read “ through fire is still some 261 million feet ”.



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# THE FORESTS OF CANADA

## 1—General Description of Canada From the Forestry Point of View

The Dominion of Canada may be divided into three main regions, namely, the Cordilleran, Great Plains, and Eastern regions. In each of these regions there are distinctive vegetative belts, the character of which is determined by climatic or physiographic conditions. Within these belts there are numerous forest types which are largely the result of local soil and climatic conditions.

### *Cordilleran Region*

The Cordilleran region is characterized by numerous ranges of mountains running in a general northwesterly direction parallel to the Pacific Coast. These mountains, of which the Rocky mountains form the eastern and most prominent system, are called the Cordilleras in Canada. The Rocky mountains vary in elevation from 5,000 to 13,000 feet above sea-level, and many of the peaks exceed 11,000 feet. Between the Rocky mountains and the Pacific ocean are the Columbia system, comprising the Selkirk, Monashee, and Cariboo mountains; the Interior Plateau system, including the Fraser and Nechako plateaux; the Cassiar system, comprising the Stikine, Babine and other mountains; the Yukon system; the Pacific system, comprising the Cascade, Coast, Bulkley, and other mountains; and the Insular system, which is represented by the mountains on Vancouver island and the Queen Charlotte islands.

Between the principal mountain ranges there are broad, well drained U-shaped trenches, the chief of which are the Rocky Mountain, the Purcell, the Selkirk, and the Coastal trenches.

These valleys are of great strategic value from the standpoint of the exploitation of the forests, for not only do they contain the principal waterways, but they provide means of access by roads and railways to the vast interior resources in lands, mines, and forests. Several of the larger rivers, such as the Fraser, Skeena, and their tributaries, break through by connecting valleys from one trench to another, and supply shorter routes of communication between the intermontane trenches and the ocean ports.

The agricultural land, which comprises approximately six per cent of this region, is confined chiefly to the valley bottoms and alluvial deltas.

The Rocky mountains and the islands on the coast are formed chiefly of Palaeozoic rocks. The Coast range is almost entirely granitic in formation, and the Selkirks are almost entirely pre-Cambrian or Cambrian. The intervening ranges are of mixed formations, varying from rocks of sedimentary origin to granites and volcanic intrusives.

### *Great Plains Region*

From the geological point of view the Great Plains are limited to an area lying south of the Canadian Shield of pre-Cambrian rocks, but, as far as the forests, drainage, and general topography are concerned, the Great Plains region may be taken as including all of the vast interior basin, extending from the foot-hills of the Rocky mountains to the eastern boundary of Manitoba and north to the Arctic ocean. The principal rivers rise in the eastern slope of the Rockies, the Mackenzie flowing north into the Arctic ocean and the Nelson and Churchill into Hudson bay. There are no real mountains in this region, though the Cypress hills in Alberta rise 2,600 feet above the surrounding plain, and the Riding and Duck mountains in Manitoba 1,000 to 1,600 feet. In general, this region slopes gradually from an elevation of about 3,000 feet at the base of the Rockies towards the north and east till it reaches tide-water.

From the mountains to lake Winnipeg, the underlying rock is of the Mesozoic and Tertiary periods. Over this is a deep layer of fertile soil, which makes the prairies of this region so productive for agriculture. North of this, in the vicinity of Great Slave lake, is an extensive area of Devonian rock. North of a line extending from the mouth of the Mackenzie river to lake Winnipeg and lake of the Woods, the geological formation is pre-Cambrian, chiefly Laurentian, being part of the great Canadian Shield, which stretches across Canada to the Labrador coast and extends south to an apex at the Thousand islands in the St. Lawrence river.

### *Eastern Region*

The Eastern region, which includes the provinces of Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island, drains either into Hudson bay on the north or into the Atlantic ocean. The St. Lawrence waterways system, of which the Great Lakes are a part, extends nearly half-way across the continent and drains the southern part of Ontario and Quebec.

Though there are no very high mountains in this region, the Laurentian Highlands of the Canadian Shield north of the St. Lawrence river have a general elevation of from 1,000 to 2,000 feet and a few peaks rise above 2,600 feet. A northern extension of the Appalachian system approaches the St. Lawrence below Quebec city and extends along the Gaspé peninsula, where peaks rising to 3,500 feet occur. The highlands of New Brunswick are also part of this system of mountains. An additional range apparently forms the province of Nova Scotia, though in few places does the elevation exceed 1,500 feet. The St. Lawrence lowlands constitute a plain of low relief extending from a little below Quebec to Lake Huron. This is primarily an agricultural district.



South of the Canadian Shield, already referred to, a great variety of geological formations occurs, but they are for the most part of the Palaeozoic period, ranging from Ordovician to Upper Carboniferous.

## 2—Main Types of Forest Growth

### CORDILLERAN REGION

The Cordilleran region contains five belts in which the climatic conditions are so distinct as to produce forests of different characters. These are the Coast, Interior Dry, Interior Wet, Rocky Mountain, and Sub-Arctic belts.

#### COAST BELT

Along the coast of British Columbia to the west of the summit of the Cascade and Coast mountains, the climate is mild, equable, and humid. The mean annual temperature varies from 44° to 49° F., with a summer mean of 55° to 61° and a winter mean of 30° to 38°, according to latitude. The precipitation is the heaviest in Canada and varies from 40 to 120 inches, depending on the position of the minor ranges of the Coast mountains, which, by intercepting the west winds blowing from the Pacific, cause them to discharge the greater part of their moisture. The major part of this precipitation, however, does not fall during the growing season, but occurs during the fall and winter, only 30 per cent falling during the spring and summer. This is sometimes given as a reason for the prevalence of coniferous forests, the claim being made that broad-leaved trees require more moisture during the growing season. The coniferous trees in this region grow most luxuriantly, and the largest individual trees as well as the heaviest stands of timber in Canada are found in this belt.

#### *Douglas Fir & Western Red Cedar Type*

In the southern portions of the Coast Belt, the Douglas fir & Western cedar type generally extends from sea-level to 2,000 or 2,500 feet altitude. Towards the northern limit the altitudinal range decreases. Associated with the principal species are Western hemlock, Western white pine, lowland fir, and amabilis fir.

#### *Western Red Cedar & Western Hemlock Type*

As the Douglas fir disappears from the stands towards the north or at higher altitudes, the forest changes to a red cedar & hemlock type with amabilis fir and yellow cypress as subsidiary species. This type descends to sea-level between Knight's inlet and Rivers inlet on the mainland and Barkley sound and Quatsino sound on Vancouver island. It has an altitudinal range of from 1,500 to 3,000 feet above sea-level.

#### *Western Hemlock & Sitka Spruce Type*

The Western Hemlock & Sitka Spruce type is a lowland type prevalent in the northern portion of the Coast belt between Rivers inlet and Portland canal and especially on the Queen Charlotte islands. It occurs also on well-watered situations along valley bottoms within the range of Douglas fir.

#### *Western Hemlock & True Fir Type*

Occupying a climatic zone somewhat less favourable than the red cedar & hemlock or the hemlock & Sitka spruce types, the hemlock & balsam fir type occurs either on higher or more exposed or wetter sites. It has an altitudinal range of from 1,500 to 3,500, or, in some situations, 4,000 feet. It is not present on the Queen Charlotte islands.

#### *Sub-Alpine and Muskeg Type*

At higher elevations between the merchantable timber line and the absolute timber line there is a sub-alpine type of stunted tree growth, composed chiefly of mountain hemlock, yellow cypress, and alpine fir, with, occasionally, red cedar, lodgepole pine, or white-bark pine. A similar type is found on very wet or exposed situations at lower elevations along the coast.

#### *Deciduous Type*

On the alluvial bottomlands of many of the larger valleys, stands of black cottonwood occur. It is associated with alder and broad-leaved maple. This is typically a pioneer type on newly formed land.

#### INTERIOR DRY BELT

The moisture in the prevailing west winds having been precipitated to a large extent on the western slope of the Coast and Cascade mountains, the southern part of the Interior plateau is of a semi-arid character and is known as the Interior Dry Belt. This condition extends through the valleys of the southern portion of the Monashee, Selkirk, and Rocky mountains to the Crows-nest pass. In this belt the annual precipitation varies from 10 to 20 inches, and the range of temperature extends from 100° to -45° F. This climate is naturally less favourable to tree growth, and open park-like stands are characteristic of this belt, especially at the lower altitudes. At higher elevations there is more moisture, and the stands become denser. In the northern part of the Interior plateau there is more moisture and lower temperature, resulting in denser stands of smaller trees somewhat similar to the northern forest belt on the Great Plains.



*Treeless Type*

In the lower portions of the valleys in the southern part of the Interior Plateau, there is a treeless type characterized by a growth of sagebrush (*Artemisia tridentata*) in the driest situations in the bottoms of the valleys and by bunch grass (*Agropyron spicatum*) on the higher mountain sides and benches. The land is very fertile when irrigated, and the bunch grass provides excellent grazing.

*Yellow Pine Type*

Bordering on the grass lands, open park-like stands of Western yellow pine occur, becoming denser as the elevation and moisture increase until fairly dense stands develop. This type usually occurs at altitudes between 1,500 and 2,500 feet above sea-level, but may extend to 3,000 feet on southern exposures.

*Interior Douglas Fir Type*

As the altitude increases, Douglas fir gradually becomes more prominent in the yellow pine type until it becomes predominant. It extends to elevations of 3,500 to 4,500 feet. The Douglas fir of the Interior differs markedly from that of the Coast Belt. It is smaller, shorter-boled, and more limby, and is much hardier when subjected to extreme climatic conditions.

*Douglas Fir & Western Larch Type*

In the southeastern part of the Interior Dry belt, this type covers a limited area usually between the yellow pine and Douglas fir types. Forest fires have played an important part in the formation of this type, since the thick bark of the larch makes it more resistant to fire than the concomitant species.

*Engelmann Spruce Type*

At the upper altitudinal and latitudinal limits of the Douglas fir type, the Engelmann spruce type develops. This type merges into a spruce & alpine fir type and, finally, the sub-alpine type.

*Lodgepole Pine Type*

As a result of repeated fires, lodgepole pine has replaced the original forests to a very considerable extent in the Douglas fir and Engelmann spruce types, and has also encroached on the yellow pine type. The transformation has been so extensive and so complete that lodgepole pine must be considered as an established type from a managerial aspect. In many places reproduction of Douglas fir and Engelmann spruce is present under the lodgepole pine, giving promise, if afforded protection from fire, of the final reversion to the climax type.

## INTERIOR WET BELT

After crossing the plateaux, the westerly winds from the Pacific ocean strike the higher mountain ranges which lie to the east, and are compelled to ascend their western slopes. The consequent precipitation is much greater than that of the Dry belt, and, as a result, types of forest which resemble those in the Coast belt are produced. This belt includes the Monashee, Cariboo, and Selkirk mountains and the Rocky Mountain trench from the Canadian Pacific railway north to the headwaters of the Parsnip river. In this belt the average precipitation is over 30 inches and in some places as high as 60 inches, a large proportion at the higher altitudes being in the form of snow. Extremes of temperature recorded vary from 100° F. in summer to -17° F. in winter. The mean daily temperature is about 44° F.

The distribution of the forest types is determined primarily by altitude and latitude.

*Interior Western Red Cedar Type*

The increased precipitation in this belt has resulted in the development of forest types similar to those found on the Coast. In the wetter situations in the valleys, red cedar becomes the predominating species. In the southern portion of the belt it is associated with Douglas fir, Engelmann spruce, Western white pine, hemlock, larch, lowland fir, alpine fir, and cottonwood. Farther north, alpine fir and Engelmann spruce become more prominent, and the other species drop out of the type.

*Western Red Cedar & Hemlock Type*

On the benches and lower slopes of the valleys in the southern portion of the Interior Wet belt, red cedar and hemlock are the principal species. The altitudinal range of this type is between 3,000 and 4,000 feet.

*Western Red Cedar & Engelmann Spruce Type*

Engelmann spruce replaces the hemlock at higher elevations; finally the cedar is eliminated and the Engelmann spruce & alpine fir type extends to the limit of commercial tree growth.

## ROCKY MOUNTAIN BELT

This belt includes both the eastern and western slopes of the Rockies. The climatic conditions vary with the altitude, latitude, and exposure. In general, the temperature is lower than in the belts to the west, and a greater proportion of the precipitation comes in the form of snow. The Interior Dry and Wet belts extend up the valleys on the western slope, and a considerable portion of the area is above timberline.



*Engelmann Spruce & Alpine Fir Type*

This type is assumed to be the climax type over most of this belt, but owing to repeated fires it has to a large extent been replaced by lodgepole pine. In some places the spruce and fir will recover control, but in others it has been practically eliminated. This type usually occurs at altitudes between 3,500 to 4,000 feet, and 5,000 to 6,000 feet. At the lower part of the range spruce predominates, giving place to alpine fir at higher altitudes. From the Peace River valley north, white spruce replaces Engelmann spruce. Douglas fir occurs in favourable situations as far north as Jasper National Park, and extends to the eastern foothills.

## SUB-ARCTIC BELT

In the Yukon plateau and the extreme northern part of the Rocky Mountain system north of latitude 58 degrees north, the general elevation is over 4,000 feet above sea-level, the climate is severe, the growing season short, and precipitation scant. As a result, forests develop only on the more favourable sites in the valleys, and grow very slowly. The trees are small and of poor quality, but, though of little commercial value, the wood is of very great value to the mining industry and to the trappers.

*Forest Types*

The principal forest type in this belt is the white spruce & alpine fir. The lodgepole pine type occurs on the poorer soils, where the original forest has been badly burned. Poplar groves and willow thickets occupy the richer soils where the coniferous forest has been completely destroyed by fire.

## GREAT PLAINS REGION

There are four vegetative belts in this region, namely, the prairie, northern forest, sub-arctic, and arctic.

## PRAIRIE BELT

In the southern portions of Alberta, Saskatchewan, and Manitoba there is a large area—about 105,000 square miles—which is practically treeless, and in its natural state was a huge grass-covered plain, mostly flat, but in some localities gently rolling. Deep valleys have been cut by some of the larger rivers. These prairies extend about 250 miles north from the International Boundary along the foot-hills of the Rockies and taper to a point near the southeast corner of Manitoba. Prairie conditions extend through the adjoining states—North Dakota and Montana—and southward. The occurrence of scattered patches of tree growth adjacent to natural fire-breaks, such as streams, lakes, and hills, would indicate that fires have been responsible to a large extent for the absence of forests in this area. Aspen is the most prevalent species in the natural “bluffs” (as these patches of trees are called), but white spruce and jack pine are found in some places. With the extension of settlement and the control of the prairie fires the natural groves of trees have greatly increased in number and size, and, as a result of the assistance given by the Dominion Government, many thousands of plantations have been established on the farms, so that the unbroken prairie landscape has been altered to a considerable extent. The soil is generally composed of a deep layer of rich clay, which is of high agricultural value. The climate is severe in winter but warm in summer, with long hours of sunlight, which is conducive to rapid growth. The amount of precipitation varies from 13 inches to over 20 inches, being less in the southwest portion of the belt. The winter climate in Alberta is tempered by the warm, dry wind known as the “Chinook,” which blows from the southwest.

## NORTHERN FOREST BELT

North of the prairie there is a forest belt from 300 to 400 miles wide with an intervening transition zone partly prairie and partly forest. In the latter there is, for the most part, agricultural land, but, in the Northern Forest belt proper, there is comparatively little land suitable for agricultural development. The northeastern part of this belt is underlain by the pre-Cambrian rocks of the Canadian Shield, which are usually very close to the surface, if not exposed. The impervious rocks obstruct the drainage, and numerous lakes, swamps, and open muskegs are formed. On the whole, the forests are of secondary commercial importance, having been severely damaged by fire, but wherever the soil conditions are suitable the growth is rapid and the protection now being provided against fire is resulting in the steady improvement of the forests. Black spruce, white spruce, jack pine, larch, balsam fir, aspen, and white birch are the pre-dominating species in this belt. This same belt extends across northern Ontario and Quebec to Labrador.

*White Spruce Type*

From the commercial standpoint, the most important type in these forests is the white spruce type. Though it has been decimated by fire, most of the logging operations are conducted in this type. Under natural conditions it occupies the heavier, well-drained soils. Balsam fir is frequently associated with white spruce, especially in the eastern portion of the belt, but forms a small proportion of the stand.

*Black Spruce Type*

Black spruce, either pure or associated with tamarack (Eastern larch), is found on poorly drained lands which comprise a considerable portion of the area.



*Spruce & Aspen Type*

The finest spruce timber from the standpoint of saw material is produced in mixed stands. These usually occupy the richer and better-drained soils, favourable to rapid growth.

*Jack Pine Type*

Like the lodgepole pine, to which it is closely related, jack pine has gained ascendance over the spruce through the agency of fire. In some situations, especially on the lighter soils, it has formed a permanent managerial type, but on others it may be considered a temporary type.

*Intolerant-Hardwood Type*

So severely have the coniferous forests suffered from fire that aspen has become the prevalent species throughout the Northern Forest belt. Though it will eventually be replaced by conifers where there is a possibility of securing reproduction of these species, over vast areas there is no immediate prospect of securing a coniferous forest by natural agencies. In the eastern portion of the belt, white birch is frequently associated with the aspen, and on moist situations such as along streams, balsam poplar occurs.

## SUB-ARCTIC BELT

The forests gradually diminish towards the north, giving place, except along the water-courses, to the sub-Arctic "tundra," a region of bogs and bare glacier-worn rocks of the Canadian Shield. The occurrence of spruce trees 12 to 16 inches in diameter, even as far north as McPherson (Lat. 67° 25' N.) indicates that soil conditions, and perhaps fire, have had more influence than climatic conditions in the limitations of the forests. What timber there is in this belt is valuable for the protection of game and the use of the local inhabitants. This belt also extends across Ontario and Quebec. Black and white spruce, jack pine, larch, aspen, and white birch persist in this northern belt.

## ARCTIC BELT

The extreme northeastern portion of the Great Plains region is treeless. The northern limit of tree growth may be roughly indicated by a line drawn from the mouth of the Mackenzie river on the Arctic ocean to the mouth of the Churchill river at Hudson bay, and across the Labrador peninsula at about latitude 58° N.

## EASTERN REGION

The forests of the eastern region are more diversified than those of the Cordilleran or Great Plains regions and several belts with distinct characteristics are recognized, namely, the Carolinian, Tolerant Hardwood, Acadian, Mixed Hardwood-Softwood, Transition, Northern, and Sub-Arctic belts.

## CAROLINIAN BELT

This belt is the northern extremity of a similar zone in the United States. It is confined to the southwestern portion of Ontario bordering on lake Erie and the western end of lake Ontario. It is characterized by several species of broad-leaved trees seldom or never found elsewhere in Canada. These are the tulip tree (*Liriodendron Tulipifera*), sycamore (*Platanus occidentalis*), sassafras (*Sassafras variifolium*), chestnut (*Castanea dentata*), black gum (*Nyssa sylvatica*), papaw (*Asimina triloba*), and black walnut (*Juglans nigra*).

Agriculture, including fruit-growing and tobacco culture, is highly developed in this district and the remaining forests are in farmers' woodlots. The climate is very mild, the mean temperature being about 45° F. and the annual precipitation from 30 to 40 inches.

## TOLERANT-HARDWOOD BELT

North of the Carolinian belt and from the southern end of Georgian bay to the Eastern Townships in Quebec, the forests are composed primarily of such hardwoods as maple, elm, beech, basswood, ash, yellow birch, oak, hickory, and butternut, which are classed as tolerant on account of their shade-enduring abilities as compared with poplar and white birch, the light-demanding broad-leaved species.

Coniferous types composed of red and white pine, spruce, balsam fir, cedar, and larch frequently occur within this belt and also in the Carolinian belt, but they are usually confined to swampy or light soils. This hardwood belt is almost entirely underlain by Devonian, Silurian, and Ordovician rocks of the Palaeozoic Age, and, as the soil is of high agricultural value, only remnants of the original forests are now found in farmers' woodlots.

In this belt the mean temperature is somewhat lower, 40 to 45° F., and the annual precipitation is 33 to 43 inches.

## ACADIAN BELT

In the Maritime Provinces and the Gaspé peninsula of Quebec, the forests are primarily coniferous and are characterized by the prevalence of red, white, and black spruce. Other conifers such as balsam fir, white cedar, white, red and jack pine, hemlock, and larch, and the hardier hardwoods are also found in this belt. The geological formation is almost entirely of the Palaeozoic Age. The surface is, for the most part, broken and irregular, and there is good drainage, so that there are few lakes. There is good agricultural soil in many places, but over two-thirds of the land area is still under forest and at least one-half is essentially forest land.



The proximity of the Atlantic ocean causes the climate to be cool and moist. The mean daily temperature is between 40 and 44° F., and the annual precipitation from 40 to 50 inches, less than one-quarter of which is in the form of snow. Both soil and climate are conducive to the reproduction and rapid growth of coniferous forests.

#### MIXED HARDWOOD-SOFTWOOD BELT

Adjoining the hardwood belt in Ontario and Quebec there is a zone in which the tolerant hardwoods and softwoods associate. The northern limit of this belt extends roughly from the northeast corner of lake Superior to the mouth of the Saguenay river on the St. Lawrence. It is underlain by pre-Cambrian rocks, and the area which can be successfully developed for agriculture is limited. The surface is rolling, and numerous lakes and rivers occur. The climate is a little more severe and the precipitation slightly less than in the hardwood belt.

It is in this belt white pine reaches its maximum development, and though, since the beginning of the lumber industry in Canada, it has been subjected to most extensive exploitation, it still occupies an important position in forest production in eastern Canada. The character of the forests has been greatly altered by cutting and fire, the valuable red and white pines having been replaced to a large extent by spruce, balsam fir, jack pine, and hardwoods. This belt contains a large number of species, comprising several forest types which are determined primarily by soil conditions.

##### *Pine Type*

Red pine is frequently, but not always, associated with white pine in this type. On light soils pure stands of pine occur, but on heavier soils there is usually an admixture of shade-tolerant species, such as spruce and hemlock, and yellow birch, maple, beech, and other hardwoods which occupy a minor position in the stand. The exclusive cutting of pine, which until recently has been generally practised in these forests, has resulted in the displacement of the pine by the concomitant species.

##### *Tolerant-Hardwood Type*

Almost pure stands of hardwood composed of maple, yellow birch, elm, ash, basswood, beech, etc., are becoming more widely established. Under undisturbed conditions "hardwood ridges" carrying chiefly maple and yellow birch occur throughout this belt.

##### *White Spruce & Balsam Fir Type*

This type, though common in the virgin forests, has become more prevalent since the removal of the pine and on account of its value as pulpwood is now perhaps the most important type in this belt.

##### *Black Spruce Type*

Black spruce, usually associated with tamarack and white cedar, forms the typical stands of the swamps and low ground.

##### *Jack Pine Type*

Fire has resulted in the establishment of jack pine over very considerable areas in this belt. In some cases it is only a temporary type, but in others it has taken almost complete possession, especially on light sandy or gravelly soils. The value of jack pine for railway ties and pulpwood and the ease with which it can be grown render it a not undesirable species to perpetuate.

##### *Intolerant-Hardwood Type*

Aspen and white birch comprise a widely distributed fire type, which is for the most part temporary in character, since coniferous reproduction is generally present and will eventually dominate these short-lived species.

#### TRANSITION BELT

Between the northern limit of the tolerant hardwoods and the height of land separating the St. Lawrence and the Hudson Bay drainage areas, and including the Lake of the Woods drainage area in western Ontario, there is a belt in which the conifers typical of the Mixed Hardwood-Softwood belt (white pine, red pine, white spruce, and balsam fir) are prevalent, but the tolerant hardwoods (maple and yellow birch) are absent. Jack pine and the intolerant hardwoods (aspen and white birch) are prominent on old burns, and black spruce and tamarack occupy the swamps. This belt lies on the Canadian Shield, and the configuration is similar to the land to the south. There is comparatively little land of agricultural value. The climate is more severe, the mean temperature being between 35 and 40° F., and the precipitation 23 to 30 inches.

#### NORTHERN FOREST BELT

On the Hudson Bay drainage, the forests change to the northern forest types similar to those in the Great Plains region. Though white pine and red pine do occur for some distances north, they are relatively unimportant from a commercial point of view. Black spruce becomes more prevalent owing to the extensive areas of poorly drained lands. Jack pine is plentiful on the higher and drier sites, and the aspen & white birch type is widely distributed. The pre-Cambrian rocks underlie this belt, and there are several large areas covered with clay which are now being successfully developed for agriculture. The greater part of the belt is still under forest, however, and most of it is suitable only for forestry. The climate is more severe and the tree growth slower than they are to the south of the height of land.



SUB-ARCTIC BELT

For approximately 100 miles south of Hudson bay the forests are of the sub-Arctic type and are confined, for the most part, to the better-drained sites along the rivers. Though the climate is severe, lack of adequate drainage is the principal factor in limiting the development of the forests.

3—Area and Content of Existing Forests

Land Classification

A large part of Canada is still unmapped, but, by the use of aerial photography, knowledge of the topography and natural resources is being rapidly extended. The figures given below, though indicating a definiteness not justified by the data available, are compiled from estimates based on the information at hand.

One of the greatest needs in the development of the resources of the Dominion is a comprehensive land classification which would determine the uses to which the land is best adapted.

The total area of Canada is 3,684,563 square miles, of which 2,167,705 square miles (58·9 per cent) is included in the nine provinces, and 1,516,758 square miles (41·1 per cent) in the territories. The area of the known lakes and rivers is estimated to be 227,216 square miles, leaving a land area of 3,457,247 square miles.

The total area of present and potential agricultural land is estimated to be 564,317 square miles. At the time of the last census, 1931, the area of occupied farm lands was 254,873 square miles, of which 213,236 square miles was cleared and 41,637 square miles was in woodlots; only 90,509 square miles was under field crops. The 309,444 square miles of unoccupied agricultural land is perhaps one-half forested and the other half prairie or grass land.

About 1,836,000 square miles is unsuited for either agriculture or forestry. This consists chiefly of arctic, subarctic, and alpine lands, but includes also road allowances and lands occupied by towns and cities.

The total forest area, including forested agricultural lands, is now estimated to be 1,254,082 square miles, 36 per cent of the total land area. Allowing for the maintenance of an adequate proportion of woodlands in agricultural districts, it is considered that 1,130,000 square miles can be utilized to the best advantage under forest.

Under the present conditions of transportation and markets, there is estimated to be 800,783 square miles of accessible and productive forest land. On 396,739 square miles the timber is now of merchantable size, and on 404,044 square miles there is young growth which, if protected from fire, will produce merchantable stands. The forests on the remaining 453,299 square miles, though classified as non-productive from the standpoint of commercial timber owing to geographical location or unfavourable growth conditions, are of great value through their influence on climatic conditions, water control, and game conservation, as well as a source of wood for local use.

It is estimated that of the accessible and productive forests, softwoods predominate on 473,654 square miles, and hardwoods on 105,962 square miles; on 221,176 square miles the forests are mixed softwood and hardwood.

The forests on the non-productive areas are for the most part coniferous.

In the following table the mixed type has been inserted because of its importance in Canada. Softwood types are defined as those consisting of 75·per cent or more conifers, hardwood types as those with 75 per cent or more broad-leaved species, and mixed types those with less than 75 per cent of either.

TABLE I—STATEMENT SHOWING THE TOTAL AREA OF FOREST, AGRICULTURAL, AND OTHER LAND, AND THE PERCENTAGE OF THE LAND AREA COVERED BY FOREST

—	Forest			Agri- cultural Land	Other Land	Total Land
	Merchant- able	Unprofit- able or Inaccessible	Total			
	(1) Square Miles	(2) Square Miles	(3) Square Miles	(4) Square Miles	(5) Square Miles	(6) Square Miles
Conifers.....	473,645	360,000	833,645	.....	.....	.....
Mixed wood.....	221,176	30,000	251,176	.....	.....	.....
Broad-leaved.....	105,962	63,300	169,262	.....	.....	.....
TOTAL.....	800,783	453,300	1,254,083	(a) 564,317	1,836,248	3,466,556
Forest Area as percentage of total land area.....	23·1	13·1	36·2	16·3	53·0	100%

(a) Includes 188,092 square miles at present under forest and hence also included under that category.

VOLUME OF STANDING TIMBER

The Forest Service of Canada, in co-operation with the provincial forest services, is conducting an inventory of the forest resources. It was hoped this would be completed in 1934; owing to the economic situation, however, this has not been accomplished. However, the Dominion Forest Service has completed inventories of Manitoba and New Brunswick and made considerable progress in Alberta and Saskatchewan. The other provinces have all extended their inventories greatly since 1928, and as a result the estimates of the volumes of standing timber have been increased.



TABLE I (a)—CLASSIFICATION OF FOREST AND OTHER LANDS

Province or Territory	Total area sq. miles	Per cent of Grand total	Land area sq. miles	Fresh- water area sq. miles	PRODUCTIVE FORESTED LAND								Non-pro- ductive forested land sq. miles	Total forested land sq. miles	Occupied Agricultural Land			Waste and other land sq. miles	Total agricul- tural land existing and potential sq. miles
					Softwood		Mixed		Hardwood		Total All Types				Cleared	Forested	Total		
					Merchant- able sq. miles	Young growth sq. miles	Merchant- able sq. miles	Young growth sq. miles	Merchant- able sq. miles	Young growth sq. miles	Merchant- able sq. miles	Young growth sq. miles							
Prince Edward Island.....	(1) 2,184	(2) 0.05	(3) 2,184	(4) .....	(5) 485	(6) 240	(7) .....	(8) .....	(9) .....	(10) .....	(11) 485	(12) 240	(13) .....	(14) 725	(15) 1,331	(16) 530	(17) sq. miles 1,861	(18) sq. miles 128	(19) sq. miles 1,966
Nova Scotia.....	21,068	0.60	20,743	325	5,000	3,000	670	480	1,800	1,000	7,470	4,480	50	12,000	2,811	3,911	6,722	5,932	12,644
New Brunswick.....	27,985	0.75	27,473	512	5,884	2,416	7,378	3,883	1,322	890	14,584	7,189	189	21,962	2,686	3,802	6,488	2,825	16,747
Total Maritime Provs..	51,237	1.40	50,400	837	11,369	5,656	8,048	4,363	3,122	1,890	22,539	11,909	239	34,687	6,828	8,243	15,071	8,885	31,357
Quebec.....	594,534	16.10	523,534	71,000	164,400	54,000	42,700	23,400	6,400	12,600	213,500	90,000	70,000	373,500	17,608	9,430	27,038	132,426	68,352
Ontario.....	412,582	11.20	363,282	49,300	19,500	45,500	29,300	53,700	7,300	14,700	56,100	113,900	70,000	240,000	28,342	7,347	35,689	94,940	102,870
Total Eastern Provs....	1,058,353	28.70	937,216	121,137	195,269	105,156	80,048	81,463	16,822	29,190	292,139	215,809	140,239	648,187	52,778	25,020	77,798	236,251	202,579
Manitoba.....	246,512	6.70	219,723	26,789	1,835	9,115	1,100	5,120	1,680	11,650	4,615	25,885	62,500	93,000	20,489	3,155	23,644	106,234	50,594
Saskatchewan.....	251,700	6.80	237,975	13,725	1,745	7,155	2,045	7,350	3,515	20,350	7,305	34,855	40,000	82,160	81,508	5,481	86,989	74,307	125,116
Alberta.....	255,285	6.90	248,800	6,485	7,695	24,075	9,365	31,435	3,620	16,885	20,680	72,395	37,560	130,635	54,817	6,084	60,901	63,348	136,641
Total Prairie Provs....	753,497	20.40	706,498	46,999	11,275	40,345	12,510	43,905	8,815	48,885	32,600	133,135	140,060	305,795	156,814	14,720	171,534	243,889	321,351
British Columbia.....	366,255	9.90	359,279	6,976	71,000	46,100	.....	.....	.....	.....	71,000	46,100	123,000	240,100	3,640	1,894	5,534	115,539	35,317
TOTAL ALL PROVINCES..	2,178,105	59.00	2,002,993	175,112	277,544	191,601	92,558	125,368	25,637	78,075	395,739	395,044	403,299	1,194,082	213,232	41,634	254,866	595,679	550,247
Yukon.....	207,076	5.60	205,346	1,730	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North West Territories—																			
Franklin.....	554,032	14.95	546,532	7,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Keewatin.....	228,160	6.20	218,460	9,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mackenzie.....	527,490	14.25	493,225	34,265	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
TOTAL TERRITORIES....	1,516,758	41.00	1,463,563	53,195	500	4,000	250	3,000	250	2,000	1,000	9,000	50,000	60,000	4	3	7	1,403,559	14,070
GRAND TOTAL— CANADA.....	3,694,863	100.00	3,466,556	288,307	278,044	195,601	92,808	128,368	25,887	80,075	396,739	404,044	453,239	1,254,082	213,236	41,637	254,873	1,999,238	564,317

Authorities:—From Canada Year Book, 1934—Columns 1, 3, 4, 16, 17, 19 (Cols. 1 and 4 “Approximate”). Forest Service Estimate—Columns 5 to 14, both inclusive. Derived—Columns 2; 15 (difference between Columns 17 and 16); and 18 (Column 3 diminished by the sum of Columns 14 and 15).



Since about one-quarter of the total stand is inaccessible from the point of view of present use or potential utilization in the near future, owing either to the location or the character of the timber, it is felt that though it is of interest to have an estimate of the total stand, it is more important to know the amount which is accessible and available for the industries under existing conditions. Two estimates have therefore been compiled, one for the total stand and one for the accessible timber. The total stand is now estimated to be about ~~287,545~~ <sup>270,000</sup> million cubic feet and the accessible stand ~~213,251~~ <sup>221,164</sup> million cubic feet, of which ~~176,318~~ <sup>187,164</sup> million feet is softwood and ~~36,933~~ <sup>13,836</sup> is hardwood. The accessible timber of a size suitable for sawing into lumber amounts to 245,313 million board feet, and the smaller material which might be utilized for pulpwood, fuel-wood, fencing, etc., 1,107,179,000 cords.

TABLE IA—VOLUME OF STANDING TIMBER

	Merchantable		Unprofitable or Inaccessible		Total	
	Per Square Mile	Total	Per Square Mile	Total	Per Square Mile	Total
	Cu. Ft.	Million Cu. Ft.	Cu. Ft.	Million Cu. Ft.	Cu. Ft.	Million Cu. Ft.
Conifers.....	228,141	133,288	236,768	88,788	231,515	222,076
Broad-leaved.....	170,182	36,853	188,084	14,727	174,937	51,580
Total.....	212,469	170,141	228,358	130,515	218,212	273,656

NOTE.—Areas of mixedwood forest divided equally between conifers and broad-leaved for purpose of calculating volume per square mile. Merchantable timberland is considered as including all accessible and productive forest land of which more than one-half is young growth still below merchantable size. The apparent heavier stand on the "unprofitable or inaccessible" than on the "merchantable" area is due to the much larger proportion of young growth on cut-over and burned-over areas in the accessible and productive areas.

TABLE IB—ESTIMATE OF STANDS OF TIMBER OF MERCHANTABLE SIZE IN CANADA, ACCESSIBLE AND TOTAL, BY SPECIES

Species	Accessible			Total		
	Saw Material	Small Material	Total Equivalent in Standing Timber	Saw Material	Small Material	Total Equivalent in Standing Timber
	Million Bd. Ft.	Thousand Cords	Million Cu. Ft.	Million Bd. Ft.	Thousand Cords	Million Cu. Ft.
Conifers—						
Spruce.....	74,354	438,024	66,643	125,409	657,796	101,791
Jack Pine and Lodgepole Pine.....	16,545	145,364	20,502	29,057	297,114	40,596
Balsam Fir.....	22,348	134,385	20,041	44,935	217,118	33,556
Cedar.....	28,128	17,870	6,901	53,220	28,819	12,373
Hemlock.....	27,857	15,212	6,502	60,236	34,718	14,185
Douglas Fir.....	28,599	20,490	7,169	53,411	35,790	13,102
White Pine.....	9,702	10,584	3,315	10,716	11,656	3,626
Red Pine.....	3,002	3,537	1,071	3,030	3,747	1,102
Larch.....	1,893	1,171	454	2,222	2,177	630
Yellow Cedar.....	1,404	580	302	3,098	1,300	669
Ponderosa Pine.....	1,212	1,590	388	1,383	1,840	446
Total Conifers.....	215,044	788,807	133,288	386,717	1,292,075	222,076
Broad-leaved—						
Poplar.....	7,466	133,467	14,314	10,587	218,245	23,052
White Birch.....	4,677	99,072	10,436	6,327	138,965	14,588
Yellow Birch.....	9,636	33,378	5,281	11,485	38,622	6,184
Maple.....	6,087	30,331	4,214	6,903	33,629	4,706
Beech.....	634	8,066	905	813	8,747	1,009
Basswood.....	415	2,632	341	470	2,865	375
Elm.....	668	7,607	869	733	8,140	934
Ash.....	193	2,054	237	303	2,849	337
Cottonwood.....	400	600	124	800	1,200	247
Oak.....	90	1,144	128	105	1,177	135
Red Alder.....		10	1		100	10
Other Hardwoods.....	3	11	2	7	22	4
Total Broad-leaved.....	30,269	318,372	36,853	38,533	454,564	51,581
Grand Total.....	245,313	1,107,179	170,141	425,250	1,746,639	273,657



TABLE IC—ESTIMATE OF STANDS OF ACCESSIBLE TIMBER OF MERCHANTABLE SIZE IN CANADA, CONIFERS AND BROAD-LEAVED, BY PROVINCES

Provinces and regions	Conifers			Broad-leaved			Total		
	Saw material	Small material	Total equivalent in standing timber	Saw material	Small material	Total equivalent in standing timber	Saw material	Small material	Total equivalent in standing timber
	Million board feet	Thousand cords	Million cubic feet	Million board feet	Thousand cords	Million cubic feet	Million board feet	Thousand cords	Million cubic feet
Prince Edward Island.....	100	700	104	20	100	14	120	800	118
Nova Scotia.....	4,854	23,182	3,775	1,170	5,805	808	6,024	28,987	4,583
New Brunswick.....	5,657	48,070	6,863	3,944	15,737	2,359	9,601	63,807	9,222
Quebec.....	52,175	277,300	43,871	8,565	88,750	10,307	60,740	366,050	54,177
Ontario.....	23,620	251,175	34,560	9,640	105,820	12,164	33,260	356,995	46,724
Total Eastern Provinces	86,406	600,427	89,173	23,339	216,212	25,652	109,745	816,639	114,824
Manitoba.....	1,045	9,645	1,357	1,620	19,110	2,170	2,665	28,755	3,528
Saskatchewan.....	4,085	12,865	2,400	2,825	46,260	5,013	6,910	59,125	7,413
Alberta.....	7,000	74,400	10,238	2,080	36,000	3,876	9,080	110,400	14,113
Total Prairie Provinces.	12,130	96,910	13,995	6,525	101,370	11,059	18,655	198,280	25,054
British Columbia.....	116,508	91,470	30,120	405	790	143	116,913	92,260	30,263
TOTAL: ALL PROVINCES....	215,044	788,807	133,288	30,269	318,372	36,854	245,313	1,107,179	170,141

4—Principal Commercial Woods of Canada

The principal forest products of Canada are pulpwood, lumber, and fuel-wood. Other important products are shingles, railway ties, poles, lath, cooperage products, plywood, piles, mine timbers, distillation products, fencing material, tan-bark, and maple sugar and syrup. Among the minor products are Canada balsam, spruce gum, nuts, and various medicinal extracts.

There are approximately 160 arborescent species of hardwoods and 33 coniferous softwoods in Canada, but of these only 23 species of softwoods and 32 species of hardwoods can be considered as commercially important. The softwoods constitute over 80 per cent of the standing timber and 95 per cent of the lumber and pulpwood produced.

SOFTWOODS

**Pine.**—There are nine species of pine in Canada, but only five are of commercial importance.

WHITE PINE (*Pinus Strobus*) is an eastern wood extending in range from the Maritime Provinces to eastern Manitoba. It is most abundant, however, in the Ottawa valley of Ontario and Quebec and in the Great Lakes region of Ontario. Trees attain the height of 100 to 175 feet and the diameter of 3 to 4 feet. It was at one time the most important lumber species in Canada, but the stands have become so depleted that spruce and Douglas fir have surpassed it in the quantity produced. It is one of the most valuable softwoods in the world, and is exceeded in average value only by such hardwoods as walnut, oak, and chestnut.

The wood is light in colour, light in weight—about 24 pounds per cubic foot in the air-seasoned condition—but only fairly strong. It is a softwood with a fine even texture, and is noted for the ease with which it can be worked. It has low shrinkage properties and when worked has the ability of holding its shape during changes in humidity conditions. It is highly prized for pattern-making, interior finish, all types of light construction, cabinet-work, and similar uses.

WESTERN WHITE PINE (*Pinus monticola*) resembles in its general characteristics and uses the white pine of the East. In Canada it is confined to the more humid situations in the Coast and Interior Wet belts of British Columbia. It seldom forms a high proportion of the stand, and the available supply is limited. The wood is slightly heavier than Eastern white pine, weighing about 26 pounds per cubic foot, air-dry, and is also slightly harder and stronger, but in general it is used for the same purposes as the Eastern species.

RED PINE (*Pinus resinosa*) is known also as Norway Pine. It is found throughout the same region as white pine in Eastern Canada and is usually associated with it in the timber operations of the East. It is a hardier tree, has a somewhat wider range, and is in favour for reforestation on certain sites. It does not attain such large sizes as white pine, usually ranging from 75 to 125 feet in height and 20 to 30 inches in diameter.

The wood is resinous and of medium strength and weight, weighing around 28 pounds per cubic foot, air-dry. There is a strong contrast between the spring-wood and the summer-wood, giving a rather pronounced figure. It is used for all types of construction work and is often treated with preservatives for such uses as poles and piling.

PONDEROSA PINE (*Pinus ponderosa*) in Canada is confined to the Interior Dry belt of British Columbia, where it grows in open, park-like stands. Mature trees range from 20 to 40 inches in diameter and 75 to 100 feet in height.



Ponderosa pine is one of the hard pines, weighs about 32 pounds per cubic foot, and is approximately of the same strength as red pine. It is used in box construction, interior finish, and general building construction.

**JACK PINE** (*Pinus Banksiana*) is widely distributed throughout the forests of Canada from the Rocky mountains to the Atlantic coast. It is a small tree, seldom over 2 feet in diameter, but, on account of its habit of growing in dense stands, it is usually tall and straight. It is very hardy, and its wonderful reproductive power, together with the ability of its cones to withstand a severe fire without injury to the seed, have enabled it to replace the original species on large areas of burned-over land. It is therefore a very important species silviculturally.

The wood in strength is about equal to red pine and ponderosa pine. It weighs about 31 pounds per cubic foot, and is well adapted to preservative treatment. It is used extensively for railway ties, poles, and piling, and its importance as a lumber species is increasing rapidly. In addition it is used in the production of kraft paper.

**LODGEPOLE PINE** (*Pinus contorta* var. *Murrayana*) is the western species analogous to jack pine; it occurs throughout British Columbia and on the eastern slopes of the Rockies in Alberta. Its characteristics of growth, quality of wood, and uses are almost identical with those of jack pine.

**Spruce.**—Spruce is found in all the forest regions of Canada. Not only is it the most abundant wood, but it is also the principal wood used in the manufacture of pulp, and is second only to Douglas fir in lumber production. There are five indigenous species, all of which are commercially valuable. When its use for both pulp and lumber is taken into account, spruce constitutes the most important group of species in Canada.

**WHITE SPRUCE** (*Picea glauca*) occurs in every province and extends to the northern limit of tree growth, but is identified with the pulp and lumber industries principally in the prairie and eastern provinces. It usually attains the height of 75 to 100 feet and the diameter of 1 to 2 feet when mature.

The wood is light in colour and weight—about 26 pounds per cubic foot, air-dry—and is comparatively soft and easy to work. It is tough and resilient, and so is suitable for scaffolding and other types of light construction work. Its long, tough, easily bleached fibre renders it especially valuable for paper manufacture.

**RED SPRUCE** (*Picea rubra*) is confined to the Maritime Provinces and the southeastern portion of Quebec. It is similar in general characteristics and uses to white spruce, but the wood is somewhat darker, has a less subdued figure, and is slightly stronger and heavier.

**BLACK SPRUCE** (*Picea mariana*) is a smaller species, of very slow growth, usually confined to poorly drained sites. It is widely distributed and extends to the far north. Black spruce is stronger and heavier than the white and red spruces, but when sawn into lumber is used for the same purposes. No distinction is made in these three varieties in the lumber markets, all being known as eastern or Canadian spruce. Black spruce is favoured for rayon pulp manufacture because of its high and consistent yield of cellulose.

**SITKA SPRUCE** (*Picea sitchensis*) is confined to low altitudes in the Pacific Coast belt. It is a very large tree, frequently reaching 6 feet in diameter and the height of 100 to 125 feet. Sitka spruce is considered the best wood in the world for aircraft manufacture because, while possessing the strength, resiliency, and lightness of all spruces, it is also available in clear, straight-grained stock. It is also an important pulp species.

**ENGELMANN SPRUCE** (*Picea Engelmanni*) is found in the interior portions of the Cordilleran region. It grows to a larger size than white or red spruce—2 to 3 feet in diameter and 80 to 120 feet in height—but not so large as Sitka spruce. The wood is similar to white spruce and is a valuable source of lumber. It has not yet been used extensively for pulpwood owing to the lack of development of the pulp and paper industry in the region where it occurs.

**Hemlock.**—There are three species of hemlock, two of which are commercially important.

**EASTERN HEMLOCK** (*Tsuga canadensis*) is found in the southern parts of Ontario and Quebec and throughout the Maritime Provinces. It is frequently associated with the tolerant hardwoods. It grows to the height of 60 to 70 feet and the diameter of 18 to 24 inches. The wood is coarse and apt to check and warp during the drying period, but is fairly resistant to decay. It is slightly stronger than Eastern spruce and is used for railway ties, rough construction, and heavy flooring, and in the Maritimes is used extensively for shingles and siding. A limited amount is used for pulp.

**WESTERN HEMLOCK** (*Tsuga heterophylla*) occurs throughout the Coast and Interior Wet belts in British Columbia. It attains a height of from 125 to 150 feet and a diameter of from 2 to 3 feet, rarely 5 feet. The flat-sawn wood is beautifully figured, though not so striking as Douglas fir. Among the softwoods Western hemlock ranks after Western larch and Douglas fir in strength, though it is fairly light in weight (about 30 pounds per cubic foot, air-dry). It is used in all but the heaviest types of construction, and because of its attractive figure is becoming increasingly popular as panelling and interior trim. It is also used in great quantities for box construction, and in the pulp and paper industry is used more than any other wood in British Columbia for sulphite and ground-wood pulp.

**Douglas Fir** (*Pseudotsuga taxifolia*) is the only species of its genus represented in Canadian forests. It is confined to the Cordilleran region, occurring in the southern portion of the



Coast belt and throughout the interior of British Columbia as far north as the 56th parallel of north latitude and extending to the foot-hills of the Rockies in southern Alberta. It is the most important tree in British Columbia, and furnishes more lumber than any other species in the Dominion. It reaches its best development in the moist equable climate of the Coast, where it ordinarily attains the height of from 175 to 200 feet and the diameter of from 3 to 6 feet; it is occasionally 250 feet in height and 10 feet in diameter. It frequently yields 50,000 to 100,000 feet board measure per acre. In the drier regions of the Interior plateau it does not grow to such large sizes, nor are the stands so heavy.

The bark of this tree is extraordinarily thick, sometimes as much as 12 inches, with the sapwood seldom over 2 inches in thickness.

Douglas fir is among the strongest of softwoods, ranking with Southern yellow pine, though weighing less—about 37 pounds per cubic foot, air-dry. In addition to its great strength it has a very striking figure, which makes it suitable for panelling and veneer work. It is available in very large sizes for structural work, and in clear material may be had in exceptionally long, wide boards and timbers. It is valued for flooring and interior finish.

Douglas fir reproduces readily when the seeds can reach mineral soil and light is available, and it grows very rapidly under favourable conditions.

**Cedar.**—Two species of the genus *Thuja* occur in Canada. They are sometimes called “arbor vitae.”

**WESTERN RED CEDAR** (*Thuja plicata*) is found in regions of abundant precipitation in the Coast and Interior Wet belts of British Columbia. It grows to such large sizes—frequently reaching 150 feet in height and 10 feet in diameter—that it is sometimes called the “giant cedar.” It ranks second only to Douglas fir in commercial importance in British Columbia, and there is an abundant supply. The wood is light, soft, and not strong, but, owing to its resistance to decay and its freedom from warping, shrinking, and checking, it is a favoured wood for exacting purposes, particularly where conditions are favourable to fungus attack. It is the principal wood used for shingles for roofing and side-walls in Canada and the United States. The colour of the wood varies from light straw to dark reddish-brown, and it is very pleasing in interior woodwork. It is also used more than any other wood for telephone and telegraph poles, and for light boat construction.

**EASTERN WHITE CEDAR** (*Thuja occidentalis*) is a much smaller tree than the western species, being usually less than 2 feet in diameter. It grows in moist situations from eastern Manitoba to the Atlantic coast. The wood is of about the same hardness as Western red cedar, but has not such an attractive appearance. It is especially durable, and was the source of most of the shingles, poles, and posts in Eastern Canada until scarcity of the wood compelled the substitution of more plentiful species. It is in great demand also for boat and canoe construction.

**YELLOW CEDAR** (*Chamaecyparis nootkatensis*), or Yellow Cypress, is a British Columbia Coast species, occurring at high altitudes in the south but descending to tide-water along the northern coast. It is the only species of *Chamaecyparis* indigenous to Canada.

The wood is sulphur-yellow in colour and is strong, hard, even in texture, and extremely durable. It is affected little by moisture changes and is valuable as a cabinet-wood and in boat-building, in addition to special uses such as battery separators.

**True Fir.**—This is the name given to all the species of the botanical genus *Abies*.

**BALSAM FIR** (*Abies balsamea*) is widely distributed in the Great Plains and Eastern regions. It is usually found associated with white or red spruce. The wood is somewhat similar to spruce, and is used for the same purposes. In the pulp and paper industry balsam fir is used in great quantities for sulphite and ground-wood manufacture. It is a quick-growing tree, but its value in the forest is decreased by its susceptibility to damage by insects and fungi. It is from this tree that the Canada balsam of commerce is derived.

**GRAND FIR** (*Abies grandis*) occupies moist situations in the southern parts of the Coast and Interior Wet belts in British Columbia. Under favourable conditions it grows rapidly, and may reach the height of 125 to 175 feet and the diameter of from 3 to 4 feet. The wood is white, light, and soft, and makes fair lumber and good pulp.

**AMABILIS FIR** (*Abies amabilis*) is confined to the Coast belt, but it extends north to Alaska. In general characteristics of growth and wood it resembles grand fir, though it is slightly harder and heavier. This species and grand fir are used extensively for box shooK.

**ALPINE FIR** (*Abies lasiocarpa*), as the name implies, grows at the higher altitudes throughout British Columbia. It is a small tree, seldom over 2 feet in diameter; it is used to some extent for lumber, and is suitable for pulpwood.

**Larch.**—There are three species of larch in Canada, but one (*Larix Lyallii*) is a small alpine species.

**WESTERN LARCH** (*Larix occidentalis*) is confined to the southern interior portion of British Columbia in an intermediate zone between the Dry and Wet belts. It is usually found in a mixed stand with Douglas fir, and grows to the diameter of from 2 to 4 feet and the height of from 100 to 160 feet.

The wood is heavy—about 38 pounds per cubic foot, air-dry—durable, and exceptionally strong, with very distinct rings of summer-wood. It is a splendid wood for railway ties, general



construction, flooring, and finish, and would be considerably more prominent in the lumber markets but for the limited quantities available. It is also used for plywood.

**TAMARACK OR EASTERN LARCH** (*Larix laricina*) is a smaller species than Western larch found in poorly drained sites, usually associated with black spruce, from the foot-hills of the Rockies to the Atlantic coast and to the limit of tree growth in the north. The wood weighs about 35 pounds per cubic foot, air-seasoned, is hard and strong, and resists decay. It is much sought for railway ties, shipbuilding, and other uses where strength and durability are of prime importance. Practically all the mature tamarack was killed by the saw-fly some time ago, but many of the dead standing trees are still sound, and there is abundant reproduction.

### HARDWOODS

**Poplar.**—Of the seven indigenous species of poplar only three are of commercial importance.

**ASPEN** (*Populus tremuloides*) is the most widely distributed species in Canada. It is a hardy, quick-growing, but short-lived tree, and is seldom sound after it reaches 8 to 10 inches in diameter. It reproduces prolifically both by coppice and seed, and quickly becomes established on burned-over lands. If conifers are present, however, its tenure of the soil is only temporary.

The wood is soft and light, weighing only 28 pounds per cubic foot, air-dry. As lumber it is difficult to season and is fairly perishable. Its use for such purposes as excelsior, heading for cooperage, and a certain class of matches, as well as core-stock, is increasing steadily, however, and in certain sections of the country it has been used extensively for such purposes as flooring and window sash. In the Prairie Provinces it is a valuable fuel-wood, and in the east is the principal wood used in the manufacture of soda pulp, for soft, opaque papers.

**BALSAM POPLAR** (*Populus balsamifera*) has as wide a range as aspen, but is confined to rich moist sites such as the banks of rivers and bottomlands. It grows to a larger size than aspen and is used for the same purposes.

**BLACK COTTONWOOD** (*Populus trichocarpa*) is confined to the Pacific coast, where it grows on moist alluvial soils along the valley bottoms. It is a large tree, 3 to 4 feet in diameter and 80 to 125 feet in height.

The wood is light in weight, soft, and fairly strong for its weight. It is used chiefly for plywood, matches, and boxes for food products.

**Birch.**—There are seven species of birch in Canada, but the yellow, white, and Western white species are the only ones of importance.

**YELLOW BIRCH** (*Betula lutea*) is the most important hardwood in Canada. It is found in commercial quantities in the Maritime Provinces and westward to the east side of lake Superior. It also occurs along the international boundary from Fort William to the Lake of the Woods. It is the largest of the native birches, reaching the height of 75 to 100 feet and the diameter of from 2 to 4 feet. It is a shade-enduring species and is therefore classed as a tolerant hardwood.

The wood is rather heavy—weighing 44 pounds per cubic foot, air-dry—strong, hard, and fine-textured. It takes a fine polish, and is used for all kinds of furniture, flooring, cabinet-work, interior trim, automobile bodies, handles, and similar uses. It is also used for distillation purposes, and is a valuable fuel-wood.

**WHITE BIRCH** (*Betula papyrifera*) is widely distributed, extending to the northern limits of the forests. It is a small tree usually about 50 feet high and 8 to 10 inches in diameter. It is a short-lived tree, intolerant of shade, and reproduces prolifically on old burns. Alone or mixed with aspen, it forms a temporary type over large areas. The wood is inferior to yellow birch, but is valued for turnery and fuel, and may be used for soda pulp, which requires only a short-fibred wood.

The western variety, *Betula papyrifera* var. *occidentalis*, occurs in British Columbia and is similar in general characteristics.

**Maple.**—Ten species of maple occur in Canada, but four are dwarf species. They are all tolerant of shade.

**SUGAR MAPLE** (*Acer saccharum*) is also known as hard maple. Both as a source of lumber and as the source of maple sugar and syrup, it is the most important of the maples, and ranks second to yellow birch in importance among the hardwoods of Canada. Its range coincides with that of yellow birch, with which it is usually associated, and extends from the Maritime Provinces to lake Superior and from Fort William to the Lake of the Woods. Mature trees are usually from 80 to 90 feet high and 2 to 3 feet in diameter, but are sometimes larger.

The wood is slightly heavier and harder than yellow birch and is used for practically the same purposes.

**RED MAPLE** (*Acer rubrum*) occurs throughout the same range as sugar maple, but extends slightly farther north. The wood is softer and not of such good quality as sugar maple, but in general is used for the same purposes.

**SILVER MAPLE** (*Acer saccharinum*) is more limited in its distribution, being confined to the southern portions of Ontario, Quebec, and New Brunswick.



The wood is softer and lighter than that of sugar maple, and, while not so suitable as a flooring or furniture material, is preferred by certain sections of the industry for automobile bodies, and in cooperage is the favoured wood for the tongue-and-groove type of barrel stave for powdered products.

**BROAD-LEAVED MAPLE** (*Acer macrophyllum*) occurs in moist bottomlands in the Coast belt in British Columbia. It is used in British Columbia for furniture and is valued also for ornamental planting.

**MANITOBA MAPLE** (*Acer Negundo*) is a native of the Great Plains. It is a small tree with soft coarse-grained wood of little value, but owing to its hardness and quick growth it is valuable for the planting of wind-breaks on the prairies and for fuel.

**Basswood.**—Only one species (*Tilia glabra*) occurs in Canada. It is found throughout the tolerant-hardwood belt in Eastern Canada and in the southern portion of Manitoba. It is ordinarily 60 to 70 feet in height and 2 to 3 feet in diameter, with a long straight trunk.

The wood is one of the most valuable in the Dominion. It is soft, white, odourless, tasteless, and light in weight—about 29 pounds per cubic foot, air-dry. It works well and is in demand for such exacting purposes as draughting tables, venetian blinds, cabinet-work, and piano keys, and is also used extensively as heading in cooperage and for interior finish.

**Elm.**—There are three species of elm native to Canada.

**WHITE ELM** (*Ulmus americana*) has a wider distribution than any other tolerant hardwood, extending from Saskatchewan to the Maritime Provinces. It attains a considerable size, 50 to 125 feet in height and 2 to 6 feet in diameter.

The wood weighs 42 pounds per cubic foot, air-dry, and is exceedingly tough. It is easy to bend and is used more than any other wood for barrel-hoops. In slack cooperage it is the most important Canadian wood and is also used a great deal for agricultural implements, automobile bodies, and for such purposes as church pews, because of the wide stock available.

**ROCK ELM** (*Ulmus racemosa*) is found chiefly in southern Ontario. It is a heavy wood, weighing 49 pounds per cubic foot, air-dry, and is one of the toughest and hardest species available in Canada. It is very durable and is employed for such purposes as rubbing strips on wharfs, whippletrees, plough handles, and other such uses that require a tough hard-wearing wood.

**SLIPPERY ELM** (*Ulmus fulva*) occurs in the southern portions of Ontario and Quebec. In strength and weight it lies between the white and rock elms, and is usually sold mixed with the white variety as soft elm.

**Ash.**—There are five species of ash in Canada; they are chiefly confined to Eastern Canada, though green ash is native to Manitoba and Saskatchewan.

**WHITE ASH** (*Fraxinus americana*), the most important species, occurs in the southern portions of Ontario and Quebec and in the Maritime Provinces. It is usually 50 to 60 feet in height and 2 to 3 feet in diameter with a tall, straight trunk.

The wood, which is not plentiful in Canada, is hard, tough, and elastic, and weighs about 40 pounds per cubic foot, air-dry. It is a favoured wood for such purposes as tool-handles, aeroplane longerons, car construction, tennis racquets, skis, the semi-liquid classes of cooperage, and to some extent for interior finish and cabinet work.

**Beech.**—Beech (*Fagus grandifolia*) is a prominent species in the tolerant hardwood belt. It attains the diameter of from 2 to 3 feet and the height of 70 to 80 feet. The wood is approximately of the same strength and weight as sugar maple and yellow birch, but is more brittle. The grain is rather attractive, but it is a difficult wood to season. Though considered an inferior wood to birch and maple, it is used in limited quantities for flooring, painted furniture, handles, and similar purposes. It is also used with birch and maple in wood distillation and as fuel-wood.

**Oak.**—There are twelve species of oak in Canada, most of them confined to the Southern Hardwood belt in the eastern provinces, but one species (*Quercus Garryana*) occurs in British Columbia. White oak (*Quercus alba*) is the most valuable, but the supply is very limited. The wood is hard and strong, and has a beautiful grain, particularly when quarter-sawn. It is used for interior finish, flooring, and furniture, and is the world's most important wood for tight cooperage.

**RED OAK** (*Quercus borealis*) is more widely distributed, and, though the wood is not so attractive as white oak, it is used in general for the same purposes.

## 5—Ownership of Forests

In Canada the general policy of both the Dominion and the Provincial Governments has been to dispose of the timber by means of licences to cut, rather than to sell timberland outright. Under this system the State retains the ownership of the land and control of the cutting operations. Revenue is derived in the form of stumpage bonuses (either in lump sums or in payments made as the timber is cut), annual ground-rent, and royalty dues collected as and when the wood is removed. Both ground-rent and royalty dues may be adjusted at the discretion of the governments so that the public may share in any increase in stumpage values, or, as has frequently happened, reductions may be made in the rates if conditions demand them.



The Maritime Provinces did not adopt this policy to the same extent as did the rest of Canada. In Prince Edward Island practically all the forest land has been alienated and is in small holdings, chiefly farmers' woodlots. In Nova Scotia 87 per cent of the forest land is privately owned; nearly half of this is in holdings exceeding 1,000 acres. In New Brunswick nearly 62 per cent has been sold, and 20 per cent is in holdings exceeding 1,000 acres. The percentage of privately owned forest land in the other provinces is about as follows: Quebec, 8.3 per cent; Ontario, 3.3 per cent; Manitoba, 9.1 per cent; Saskatchewan, 7.6 per cent; Alberta, 7.7 per cent, and British Columbia 7.3 per cent.

In Canada, as a whole, only 8.7 per cent of the forest land has been permanently alienated; on 12.9 per cent cutting rights are held under lease or licence, and 69.1 per cent is not alienated in any form. Only 10 per cent has been permanently dedicated to forest production. This includes the provincial forest reserves and parks. There are some licensed berths within these reserved areas. About 89 per cent of the state-owned forest land has not yet been withdrawn from sale or settlement and definitely set aside for forestry purposes.

Naturally the more heavily timbered and accessible tracts have been alienated, so that on the basis of total timber content, it is estimated that about 10 per cent of the forest resources of the Dominion is in private ownership, 40 per cent under licence or lease, and 50 per cent still unalienated.

In 1930, the forest resources in the four western provinces that previously had been under the control of the Dominion government were transferred to the respective provinces, and since that date have been under their jurisdiction.

TABLE II.—FOREST AREA BY OWNERSHIP

Type of forest	Forests owned by the State				Privately owned by corporate bodies and individuals	Total
	Dedicated to timber production	Under lease or licence	Unalienated	Total state		
	(1)	(2)	(3)	(4)	(5)	(6)
	Square miles	Square miles	Square miles	Square miles	Square miles	Square miles
Accessible and productive—						
Merchantable.....	35,000	100,000	206,739	336,739	60,000	396,739
Young growth.....	74,281	47,050	316,994	364,044	40,000	404,044
Inaccessible and unprofitable.....	17,000	15,000	415,123	447,123	6,177	453,300
TOTAL.....	126,281	162,050	985,856	1,147,906	106,177	1,254,083
Percentage of total forest area.....	10.0	12.9	78.6	91.5	8.5	100

Column 1—Forest Reserves and Parks includes perhaps 10,000 square miles under licence.  
“ 2—Includes also 10,000 square miles under licences in forest reserves, 0.7 per cent of total forest area.  
“ 3—Includes 4,434 square miles of forest in Indian Reserves.

TABLE IIA—AREAS OF FOREST RESERVES AND PARKS

DOMINION			
Forest Experiment Stations—	Area Sq. Miles	National Parks of Canada—	Area Sq. Miles
Acadian, New Brunswick.....	35.00	In Nova Scotia.....	0.05
Valcartier, Quebec.....	7.25	“ New Brunswick.....	0.10
Petawawa, Ontario.....	97.10	“ Ontario.....	11.69
Duck Mountain, Manitoba.....	35.95	“ Manitoba.....	1,148.04
Kananaskis, Alberta.....	62.60	“ Saskatchewan.....	1,869.00
Total.....	237.90	“ Alberta.....	7,316.00
		“ British Columbia.....	1,715.00
			12,059.88
PROVINCIAL			
Quebec Forest Reserves—		Quebec Parks—	
Domanial Forests.....	2,490.00	Laurentides.....	3,565.00
Township Forest Reserves.....	1,269.60	Trembling Mountain.....	1,194.00
Lake St. John.....	25,400.00		
Gaspé.....	2,500.00		4,759.00
Total.....	31,659.60		
Ontario Forest Reserves—		Ontario Parks—	
Eastern.....	325.00	Algonquin.....	2,740.00
Timagami.....	5,930.00	Quetico.....	1,500.00
Mississagi.....	5,262.00	Rondeau.....	8.00
Georgian Bay.....	677.00		4,248.00
Sibley.....	80.00		
Nipigon.....	7,100.00		
Wanapitei.....	70.00		
Kawartha.....	162.00		
Total.....	19,606.00		



TABLE II—AREAS OF FOREST RESERVES AND PARKS—(Concluded)

PROVINCIAL—Concluded			
		Area	
		Sq. Miles	
<i>Manitoba Forest Reserves—</i>			
Sandilands.....	189.30		
Turtle Mountain.....	109.25		
Spruce Woods.....	223.50		
Duck Mountain.....	1,426.29		
Porcupine.....	774.75		
Whiteshell.....	1,088.00		
Total.....	3,811.09		
<i>Saskatchewan Forest Reserves—</i>			
Keppel.....	15.50		
Dundurn.....	18.50		
Cypress Hills.....	76.65		
Elbow.....	123.50		
Emma Lake.....	142.92		
Manito.....	194.05		
Nisbet.....	315.59		
Fort à la Corne.....	507.81		
Bronson Lake.....	574.03		
Amisk Lake.....	666.50		
Meadow Lake.....	860.91		
Big River.....	1,106.94		
Porcupine.....	2,280.11		
Pasquia.....	2,841.85		
Total.....	9,724.86		
<i>Saskatchewan Parks—</i>			
Katepwe Point.....		Area	
Little Manito.....		Sq. Miles	
Good Spirit Lake.....		0.03	
Cypress Hills.....		0.37	
Greenwater Lake.....		5.98	
Duck Mountain.....		18.34	
Moose Mountain.....		34.75	
Nipawin.....		81.00	
		154.00	
		252.00	
		546.47	
<i>Alberta Forest Reserves—</i>			
Rocky Mountains.....	14,329.00		
Cypress Hills.....	80.69		
Total.....	14,409.69		
<i>Alberta Parks—</i>			
Ten small areas.....		2.27	
		2.27	
<i>British Columbia Forest Reserves—</i>			
<i>Coast—</i>			
Broughton.....	67.00		
Gilford.....	175.00		
Harbledown.....	109.00		
Hardwicke.....	26.00		
Sonora Island.....	59.00		
West Thurlow Island.....	30.00		
East Thurlow Island.....	38.00		
Redonda.....	67.00		
Sayward.....	616.00		
Douglas.....	696.00		
Powell.....	679.00		
Loughborough.....	935.00		
Seechelt.....	1,210.00		
Total Coast.....	4,707.00		
<i>Interior—</i>			
Aberdeen.....	118.00		
Babine.....	2,032.00		
Barriere.....	532.00		
Elk.....	2,426.00		
Flathead.....	532.00		
Fly Hill.....	255.00		
Glacier.....	106.00		
Grizzly.....	593.00		
Inkaneep.....	321.00		
Kettle River.....	2,426.00		
Larch Hills.....	51.00		
Little White Mountain.....	291.00		
Martin Mountain.....	34.00		
Momich.....	1,566.00		
Monte Hills.....	182.00		
Morice.....	925.00		
Mt. Ida.....	52.00		
Nehalliston.....	1,105.00		
Nicola.....	340.00		
Niskonlith.....	447.00		
Okanagan.....	991.00		
Shuswap.....	326.00		
Spallumcheen.....	750.00		
Tranquille.....	278.00		
Yahk.....	976.00		
Yoho.....	127.00		
Total Interior.....	17,782.00		
Total.....	22,489.00		
Grand Total.....	101,938.14		
<i>British Columbia Parks—</i>			
<i>Coast and Interior—</i>			
Golden.....		0.17	
Garibaldi.....		973.00	
Inonoaklin.....		0.01	
Kokanee Glacier.....		100.00	
Mt. Assiniboine.....		20.00	
Mt. Robson.....		803.00	
Nakusp Hot Springs.....		0.20	
Princeton.....		0.67	
Quesnel.....		0.01	
Salt Lake.....		0.13	
Sir Alexander Mackenzie.....		0.02	
Strathcona.....		828.00	
Sooke Mountain.....		2.26	
Total B. C. Parks.....		2,727.47	
		24,343.09	



## 6—Relationship of the State to the Forest

### A.—SUMMARY OF EXISTING LEGISLATION

#### DOMINION

##### *The Natural Resources Acts, 1930*

Until the year 1930, the Dominion Government administered and protected the forests in the Provinces of Manitoba, Saskatchewan, and Alberta, and in the Railway Belt and Peace River Block of British Columbia, but in that year these natural resources were transferred to the ownership and jurisdiction of the provinces concerned.

##### *Dominion Lands Act (Ch. 113, R.S.C., 1927)*

Under this Act, at the present time, the Federal Government, through the Lands, Northwest Territories and Yukon Branch of the Department of the Interior, administers the forest resources of the Yukon and the Northwest Territories.

##### *Dominion Forest Reserves and Parks Act, 1911*

This Act set aside certain areas as Dominion Forest Reserves, but, as stated, these were transferred in 1930 to provincial control. The Act also permanently dedicated certain defined areas as Dominion (National) Parks, to be maintained and made use of as "public parks and pleasure grounds for the benefit, advantage and enjoyment of the people of Canada." The timber regulations in effect on the forest reserves, as built up under federal control, were very largely adopted and continued by the three Prairie Provinces.

##### *The National Parks Act, 1930*

The National Parks are under the control and management of the Commissioner of National Parks. Inasmuch as the underlying principle in the establishment of the parks was that the lands embraced should be maintained in a natural state, no commercial exploitation of their resources is permitted. Provision exists, however, for disposal of either green or damaged timber under permit where found desirable or necessary. The Act further provides for the adequate protection of the parks against fire and other destructive agencies.

##### *The Indian Act, 1927*

Under this Act the Department of Indian Affairs is charged with the protection and general administration of some 8,000 square miles of Indian Reservation lands. These lands, which are scattered in small areas across the country, are still to a considerable extent under forest. Timber is sold as conditions warrant for the benefit of Indians, with their consent.

##### *The Natural Products Marketing Act, 1934*

This Act provides for the regulation under a Dominion Marketing Board of the marketing of the natural products of agriculture and of the forest, sea, lake, or river. Since federal authority is limited to interprovincial and external trade, regulation of a product marketed wholly within a province can be effected only through concurrent provincial legislation. The federal control is restricted to the regulation of the marketing of the product, but the provinces can extend the operation of the Act to any phase of the marketing of the product with the backing of the federal authority. All the provinces have passed enabling legislation.

The Act provides for the appointment of local boards for the various natural products in regional areas of production. The initiative in the control of a product may be taken by the industry. The scheme provides for a maximum of flexibility and at the same time a co-ordination which will ensure a certain amount of uniformity throughout the Dominion.

The measure is designed to allow the industries to establish their own control, but provides the machinery for organization and authority for enforcing the regulations decided upon.

This Act presents an opportunity for the forest industries to organize and establish a measure of control over the trade in their products. The shingle manufacturing industry in British Columbia is the first and, as yet the only, forest industry to take advantage of it. This was done to regulate the export of shingles to the United States.

##### *Railway Act*

The Railway Act gives very wide powers to the Board of Railway Commissioners in regard to fire protection along the railways under its jurisdiction, which now includes practically all of the 41,776 miles of railway in the Dominion. The provisions of the Act fall under six classes, namely,

1. The use of fire-protective appliances on locomotives,
2. The establishment and maintenance of a properly equipped patrol staff by the railways,
3. The regulation of locomotive fuel,
4. The clearing of rights of way,
5. The financial responsibilities of railway companies for fire loss due to railway locomotives.
6. The construction and maintenance of fireguards along railway lines.



Through the orders issued by the Board under this Act and the co-operation of the companies secured thereby, the fire loss due to railways has been very greatly reduced.

#### BRITISH COLUMBIA

##### *Land Act, 1884*

This Act and amendments provided for the sale of land and the disposal of timber under leases and licences to cut. Though it originally stated that "no land chiefly valuable for timber shall be disposed of by public or private sale," it was not until 1896, when timberland was specifically defined as land carrying 8,000 feet board measure per acre when situated on the Coast and 5,000 feet board measure in the Interior, that this policy was enforced.

##### *Forest Act, 1912*

The Forest Act established the Forest Branch in the Department of Lands and placed under its jurisdiction the entire administration of the forests, including the disposal of timber, collection of revenue, regulations of cutting, forest protection, reforestation, and market extension.

##### *Taxation Act*

This Act imposes a tax of two per cent on the assessed valuation of privately owned timberland.

##### *Summary of Present Conditions of Tenure—*

*Crown Grants.*—Timber cut from land granted prior to April 7, 1887, is free of royalty, but is subject to a manufacturing tax which is rebated if the timber is manufactured within the province.

Timberlands purchased subsequent to that date and prior to March 12, 1906, are subject to a royalty of 50 cents per thousand feet board measure, and the logs are exported without charge.

Lands granted after March 12, 1906, till March 1, 1914, are subject to a royalty of 50 cents per thousand feet board measure, and the logs are not exportable.

Timber cut from lands granted since March 1, 1914, is subject to the same royalty as special licences and must be manufactured in the province.

*Timber Leases.*—The leasing system goes back as far as 1870. The leases were originally issued for a term of 21 years, renewable under conditions to be determined by the Government. They are now all on the same terms as special licences.

*Pulp Leases.*—In 1901, provision was made for granting leases to pulp and paper companies which were renewable for consecutive periods of 21 years. The annual rental is one-half the rental on special licences and the royalty 25 cents per cord (700 feet board measure, or 100 cubic feet).

*Special Licences.*—Most of the alienated timber is held under special licences, which are limited to 640 acres each. They are renewable annually in perpetuity, subject to cutting regulations in force from year to year. After cutting, the licence lapses, or renewal may be refused if the land is required for agriculture. An annual ground-rent of \$140 per square mile is charged west of the Coast-Cascade mountains and \$100 per square mile east of that range. The scale of royalty is adjusted at intervals of five years, and, in the case of logs, it varies as to whether on the Coast or in the Interior and as to the species and quality. Other products, such as ties, poles, pulpwood, etc., carry individual rates.

*Timber Sales.*—Since 1908, Crown timber has been disposed of only by timber sales, which are awarded after public competition to the one bidding the highest stumpage price. Each sale contract specifies the period within which operations are required to be completed. The ground-rent is the same as on special licences. Within Provincial Forests operations are conducted on a sustained-yield basis.

*Manufacturers of Crown Timber.*—In order to encourage home manufacture, the exportation of raw material, logs, bolts, poles, piling, etc., cut from private lands granted subsequent to March 12, 1906, and from all Crown lands (leases, licences, and timber sales) is prohibited, except under special permit and the payment of an export tax. To assist the government in regulating export, an Advisory Committee representing equally the logging industry, the lumber manufacturers, and the Forest Service meets each month to review the situation and pass on the applications for export permits.

*Forest Protection Fund.*—All alienated Crown Lands and privately owned lands classified and taxed as timberlands under the Taxation Act are required to contribute towards the Forest Protection Fund. The present tax is  $2\frac{1}{2}$  cents per acre per annum. The Government contributes an additional \$300,000 annually. The fund is administered by the Forest Branch exclusively for forest fire protection.

*Timber Measurement.*—All timber for which a royalty is payable is scaled and graded by government scalers. A small fee which pays for this service is charged.



## ALBERTA

*Provincial Lands Act*

Under this Act the Director of Lands of the Department of Lands and Mines is authorized to dispose of timber growing on Crown lands and included in Forest Reserves. Timber berths, not exceeding twenty-five square miles in extent, and with annually renewable licences, may be sold by tender, based on a lump-sum bonus. Permit berths, annually renewable for not more than five years, are granted on areas not exceeding one square mile in the case of green timber, and nine square miles in fire-killed timber. Permits are issued for small quantities of wood.

*Alberta Forest Reserves Act*

This Act provides for the appointment of a Director of Forestry, and of the staff of the provincial Forest Service. It also provides for the administration of the Forest Reserves, including their protection from fires.

Timber on the reserves is disposed of by timber sales, or by permits. Regulations in force require the disposal of logging slash, and restrict the trees to be cut to those designated by a forest officer. The Scribner Log Rule is the official scale for logs.

*Prairie Fires Act*

This Act is generally similar to the corresponding Acts in the other prairie provinces. Fire guardians may be appointed by the Minister of Agriculture. Officers of the Forest Service may take steps to control fires outside reserves, acting as fire guardians under the Act. The closed season for setting out fires is from April 15 to November 15.

## SASKATCHEWAN

*Forest Act, 1931*

The forests are administered by the Department of National Resources under this Act. An officer known as the Director of Forests is appointed to administer the Act and Regulations made thereunder.

Timber berths, timber sales, permits, and pulpwood licences are disposed of under conditions similar to those in force in Manitoba. However, timber-berth licences are renewable annually for so long as merchantable timber of the size and kind described in the licence exists on the berth. Rates of dues payable by licensees are modified according to the selling price of lumber. When lumber sells at less than \$15 per thousand feet board measure the royalty on kinds other than poplar is \$0.50, rising to 8 per cent of sales values when the selling price is over \$30 per thousand feet.

Disposal of logging slash, by burning or otherwise, is required; and trees to be cut are designated by a forest officer. Clark's International Log Rule is the legal measure for logs.

*Prairie and Forest Fires Act*

This Act provides for the appointment of fire guardians, and the prevention and suppression of fires. Certain districts are defined in the Act, in which permits are required to set out fire between April 1 and November 15 in any year. Provision is made for precautions to be taken by operators of locomotives or of other engines. The sections regarding forest fires apply to all crown forests, inside or outside reserves.

*Timber Taxation Act*

By this Act holders of timber berths are required to pay a tax of one cent per acre per year, the minimum payment being \$25. If operations are conducted on the berth, a rebate, not exceeding one-half cent per acre, may be granted.

## MANITOBA

*Forest Act, 1930*

This Act, fully described as "An Act respecting Crown Timber and Forest Resources," came into force on the transfer of natural resources from Dominion to Provincial control. It established the Manitoba Forest Service in the Department of Mines and Natural Resources, and authorized it to administer all provincial timber, both inside and outside the forest reserves. The Act also includes authority for the prevention and suppression of forest fires within the reserves. Forest Regulations, issued by the Department under the Act, govern administrative procedure. This Act delimits the forest reserves.

Timber berths, not exceeding twenty-five square miles in area, may be disposed of, by public competition, to the bidder of the highest lump sum bonus. Licences to cut are issued annually, and may be renewed for a period not to exceed fifteen years. Ground rental is charged at the rate of \$10 per square mile per annum. The licensee is required to pay one-half of the cost incurred by government in protecting his holdings from fire. Royalties are payable periodically as the timber is manufactured.

Timber sales are made, of quantities of timber not exceeding a value of \$25,000 in dues, and for periods not to exceed five years. Disposal is by public auction, during which applicants may bid up the "upset" rates of dues.



Permits are issued for small quantities of timber, and are good for one year only. Dues are collected for paid permits, while free permits, for limited quantities of material, are available to settlers.

Pulpwood berths can be disposed of only after ratification by the Legislature.

Disposal of logging slash by burning is required of all operators. Cutting must be restricted to trees indicated by a forest officer, and penalties are provided for unauthorized cutting. The legal log rule is Clark's International Rule for  $\frac{1}{4}$ -inch kerf.

#### *Fires Prevention Act, 1917*

Part I of this Act provides authority for the prevention and suppression of fires outside of forest reserves. Wooded districts are defined by proclamation, and fire guardians are appointed by municipalities. Forest officers are granted the powers of fire guardians. From April 1 to November 15 no person is permitted to light a fire without first obtaining authority from the local fire guardian, only fires lighted for cooking, warmth, or industrial purposes being excepted. Provisions are made for the supervision and control of fires for land clearing, and duties of residents respecting the suppression of fires are defined.

#### ONTARIO

##### *Crown Timber Act*

This Act authorizes the Minister of Lands and Forests to dispose of timber on the Crown lands in Ontario. With the regulations made thereunder, it governs the sale, cutting, and measurement of the timber, the collection of revenue from the timber and lands, and the control of manufacture of wood from these lands.

Licences to cut saw material are granted by tender on the basis of a per unit bonus over and above the regular royalty payable when the timber is cut. The licences are renewable annually at the discretion of the Minister. An annual ground rental and fire-protection tax is charged.

Cutting rights for pulpwood are granted by individual agreements good for 21 years. These agreements stipulate a minimum mill capacity, cost of plant, number of employees, and other conditions.

The timber cut is measured by government scalers, half of whose wages is collected from the licensees.

The manufacture in Canada of saw-timber cut on Ontario Crown lands has been required since 1897, of pulpwood since 1900, and of hardwood saw material since 1926. In 1935, however, provision was made for the export of pulpwood under special permits.

##### *The Forestry Act*

This Act provides power to acquire lands for forestry purposes, and for the administration and management of such lands, gives power to enter into agreements for the purposes of reforesting and managing lands held by persons, corporations, or municipalities, to remove settlers from unsuitable areas, and to place them on lands suitable for agriculture.

This Act also provides for the establishment of a Forestry Board to consist of five members for the purpose of carrying on research work in connection with the forestry lands of the province and to advise the Government on matters of forest policy.

##### *Forest Fires Prevention Act*

All the province except the southerly agricultural portion comes under the provisions of this Act, for the purposes of forest protection. The Act establishes a close season throughout the province from April 15 to September 30, during which fires may be set out for clearing land, disposal of debris, or for any industrial purpose, only under circumstances and subject to conditions prescribed by the regulations. The Act provides for the extension of the close season, use of permit system, regulation of engines and burners, prevention of the creation of fire hazards, etc. There is provision for the compulsory clearing up of any conditions, including slash from ordinary logging operations, which may be a fire menace; this applies also to private lands. If the clearing is not done by the owner, it may be carried out independently and the cost collected. There is the customary provision for the organization of personnel, purchase of equipment, and carrying on of improvement work, so as to carry out the intent of the Act.

##### *Fires Extinguishment Act*

This is a little-known Act meant mainly for application outside the provincial fire district. It provides that township and county councils may, by by-law, empower certain of their officials to compel the local people to fight woods fires.

##### *Fire Guardians Act*

This Act provides for municipalities outside the fire districts (Forest Fires Prevention Act) appointing fire guardians to have control of the setting out of fire.

##### *Counties Reforestation Act*

This Act enables municipalities, by by-law, to acquire land for reforestation purposes, manage and develop plantations, and enter into agreements for their development. A limit of \$25,000 debenture issue for land is fixed.



*The Mills Licensing Act*

This Act provides for the requirement of securing a licence to operate sawmills or pulp and paper mills, and provides also for the control of locating mills and prescribing the returns to be made as to sources of supply of raw material and quantities used therein.

*The Timber Cutting Regulation Act*

This Act provides power for the Minister of Lands and Forests to fix the size and kind of trees and timber which may be cut from Crown Lands and on patented lands where the timber thereon remains the property of the Crown.

*Provincial Parks Act*

This Act permits establishment of a Provincial Park by Order in Council. Its essential feature is that settlement is strictly prohibited. Under strict control, timber may be cut either under licence by authority of the Minister or under an Order in Council.

*The Lakes and Rivers Improvement Act*

This Act provides for the safe and orderly floating of timber and pulpwood down lakes or rivers and the prevention of log-driving operations from unduly interfering with navigable waters.

*The Cullers Act*

This Act provides for Boards of Examiners charged with the duty of examining and testing all applicants for an Ontario Scalers' licence. All licensed cullers or scalers must, on request of the Crown Timber Agent, submit their books and records for inspection.

*The Pulpwood Conservation Act*

This Act includes in its scope all the pulpwood species. Every licensee, operator, or manufacturer is required to prepare and submit detailed information concerning his operations according to a schedule provided. As part thereof, a detailed estimate of Crown timber holdings is called for, together with a tentative plan of future cutting based on sustained yield.

The Minister is given the most complete authority to direct and control all cutting operations, with the object of placing the pulpwood forests of Ontario on a sustained-yield basis. Provision is made for the growing of spruce or other nursery stock, to be furnished to operators at nominal prices for the planting of their holdings.

*The Provincial Forests Act*

This Act sets aside certain described tracts of land as Provincial Forests. These may be enlarged or new ones created, by Order in Council. All Provincial Forests are placed directly under the management of the Minister of Lands and Forests. The Act provides further for the appointment of a forester in charge of these forests. On recommendation of the Minister, a Provincial Forest may be put to any use not inconsistent with the growing of timber. Settlement is prohibited, and the surrender of cut-over limits provided for.

*The Public Lands Act*

This Act provides for a Deputy Minister of Lands and Forests who, in the absence of the Minister, shall act in his place. A Deputy Minister of Forestry is also provided for, whose duties shall comprise reforestation, forest protection, forest research, and any other matters assigned by the Minister, or by Order in Council.

*The Woodmen's Employment Act*

Under this Act every operator on Crown lands, or a contractor or sub-contractor, is made subject to government inspection with respect to every phase of his work which concerns the employment of labour.

This inspection covers, *inter alia*, the wages paid and hours of labour; food furnished and price charged therefor; living accommodation provided; deductions for medical and other services; work hazards; labour contracts, and other matters. The Inspector is permitted free right of entry to any part of the operator's lands or premises. The operator is held responsible for carrying out every requirement of the Act.

## QUEBEC

*Lands and Forests Act*

The laws respecting lands and forests and the timber regulations in the Revised Statutes of Quebec, 1925, place the administration of the forests under the Forest Service of the Department of Lands and Forests. This includes the classification of the land, disposal of timber, regulation of cutting operations, measurement of timber cut, collection of revenue, reforestation, and all other matters pertaining to the forests.

Licences to cut timber are disposed of by public competition to the bidder of the highest stumpage bonus in excess of a fixed bonus per square mile, and the regular royalty on timber



cut. An annual ground-rent is also charged. Licences are renewable from year to year, but the rate of royalty and of ground-rent may be changed by the Government at any time. The export of unmanufactured wood from Crown lands is prohibited. The timber cut is measured by licensed scalers, and operators by whom they are employed are required to make returns of the amounts. Minimum-diameter limits to which the timber may be cut are fixed, but modifications are allowed when working plans acceptable to the Forest Service show that such are necessary for the best silvicultural practice. Logging operations are inspected by the forest engineers of the Service, and when deemed advisable the amount to be cut is prescribed. It is the aim of the Department to limit the cut to eighty per cent of the increment.

Special efforts have been made toward ensuring a more conservative utilization of the exploited timber and reducing waste in the course of lumber operations. Regulations call for detailed inventories being made by the limit-holders. Since 1922, forest surveys have been completed on 77,000 square miles. In 1924, fire protection was placed under a special Forest Protective Service.

Land may be reserved for forestry by order of the Lieutenant Governor in Council in the form of Forest Reserves, Crown Forests, or Township Forest Reserves. Parks are established under special legislation.

#### *The Forest Research Promotion Act*

The Forest Research Promotion Act provides for maintenance of the School of Forestry, the School of Forest Rangers, and the School of Papermaking, and the establishment of forest-research stations and laboratories.

The Quebec Cullers Act provides for the examination and licensing of cullers or scalers of timber cut on Crown lands.

The Water Course Act and Timber Driving Company Act govern the driving of logs on streams and rivers.

#### *Forest Operations Commission Act*

This Act takes steps to fully regulate and safeguard labour conditions in the forest industries. Every licensee or contractor before starting an operation must provide the Commission with full details as to wages, food, and working, sanitary and other conditions about his camps.

#### *Utilization of Forest Products Act*

The object of this Act is to develop wider and more remunerative markets and more complete utilization for the forest products of Quebec. The Commission is directed to make economic studies of problems affecting the lumber industry and offer practical suggestions thereon.

#### *The Plant Protection Act, 1929*

This Act provides for a rigid annual inspection of nurseries to guard against the inroads of all destructive insect and fungal pests attacking forest trees or other plants. No compensation is allowed where government destroys alternate fungal hosts, as in case of *Ribes* (currants and gooseberries) affected or threatened by White Pine Blister Rust.

#### *The Forest Engineers Act*

This Act defines the professional qualifications requisite to membership in the Quebec Society of Forest Engineers, the object being to safeguard the dignity, honour, and prestige of that profession.

#### *Fires Prevention Act*

This general Act provides for the issuance of settlers' clearing permits, disposal of debris in railway construction; creation of Forest Protective Associations; issue of "Travel Permits;" payment of fire-fighters, and so forth.

#### *The Forest Resources Protection Act, 1935*

For the purpose of protecting the forest workers and government revenues and to assure the perpetuity of the forest resources, this Act provides: that pulp and paper companies operating on Crown land file with the government all contracts relating to the acquisition of wood cut on Crown land and to its sale and transformation into pulp or paper; that the cut be limited to the reasonable requirements; that workmen be protected as regards health and working conditions, and that the Crown dues may be raised not to exceed \$6 per cord or \$12 per thousand feet board measure for licensees who do not observe the regulations of the Act.

The Act is to become effective when proclaimed by Order in Council.

#### *Settlers' Wood-Selling Assistance Act, 1935*

This Act empowers the Quebec Forest Operations Commission "to act as agent, mandatory and intermediary to promote the sale of the wood of any settler under a location ticket." The object is to provide the individual settler with every possible information that may be useful to him in marketing this wood.

#### NEW BRUNSWICK

The administration of land and timber was originally provided for by the Crown Lands Act. Subsequently the Forest Act 1918, The Scalers Act, The Forest Service Act, and the Forest Fires Act were passed and are embodied in the Revised Statutes of New Brunswick, 1927.



The following are the main features of this legislation as at present in force:—

The Forest Service under the Minister of Lands and Mines was created in 1918, "to administer all the statutes, rules, and regulations respecting forestry, hunting and fishing, forest and game protection." A Forestry Advisory Commission, consisting of the Minister of Lands and Mines, the Deputy Minister, the Chief Forester, a lumberman representing the licensees of Crown Lands, and one representing the private timberland owners, is appointed to advise on matters of policy.

*Private Lands.*—All private forest land in tracts of 500 acres or more in area is subject to a wild-land tax of two cents per acre. In Westmorland County all private timberland of 50 acres or more is taxed for fire protection, the rate being based on the cost of the service. In other counties, the owners are required to extinguish fires on their own land, and, if they fail to do so, the municipality is required to act, and the owner of the land has to pay all the costs.

*Leases.*—Cutting rights are granted under leases disposed of by public auction. They are subject to a bonus varying from \$20 to \$100 per square mile for sawmill licensees and up to \$130 per square mile for pulpwood licensees. An annual rental of \$8 per square mile is charged, and a royalty is payable as the timber is cut. Regulations regarding the stumpage rates, methods of cutting, and measurement of timber may be revised, from time to time, by the Lieutenant-Governor in Council.

The Minister may require the holder of any licence to furnish maps and estimates of the timber for his licence. Before beginning a season's cut the licensee must notify the Department of the location, the proposed amount, and the name of the foreman in charge.

The timber cut from Crown lands must be measured by licensed scalers, and sworn returns made to the government. Pulpwood may now be legally scaled either by the board foot, if in log lengths, or by the cord, if in four-foot lengths.

The Act stipulates that all logs, timber or wood, except poplar, cut from Crown lands must be manufactured within Canada into merchantable pulp or paper or into sawn lumber, woodenware utensils, or other articles of commerce or merchandise, but an amendment provides that the licensees may be granted the privilege of exporting raw material when it is shown to be in the public interest, after full inquiry into all the circumstances of each case, under such conditions and stipulations as the Lieutenant Governor in Council may deem just and equitable.

#### *The Forest Operations Commission Act*

This is an Act which applies to the settlement of labour disputes and to the fixing of equitable wage scales in any work, undertaking, or operation connected with the lumber industry.

The Minister of Lands and Mines in co-operation with the "Forest Operations Commission," administers the Act.

#### NOVA SCOTIA

#### *Lands and Forests Act*

All provincial legislation regarding the forest and game is governed by this Act passed in 1926. It is divided into three parts, namely, Crown Lands, Forests, and Game.

*Cutting Licences.*—The Minister of Lands and Forests may grant licences to cut timber on the ungranted land of the Crown, on payment of such dues as may be in his discretion. The cutting licences are subject to regulations and restrictions prescribed by the Governor in Council.

*Fire Protection.*—Any person is liable to a penalty of not less than \$20 nor more than \$400 for each offence, if he starts a fire near the forest or for the purpose of clearing land, without exercising every reasonable care and precaution; or if such a person, between the fifteenth day of April and the first day of December, starts a fire in or near the woods for cooking purposes or any other purposes without observing certain prescribed precautions, or starts a fire for the purpose of clearing land or other like purpose without first having obtained a permit in writing from a duly appointed Forest Ranger, or operates a steam engine within sixty rods of any forest without first having obtained a permit from a duly appointed Forest Ranger.

#### B.—SUMMARY OF ADMINISTRATIVE METHODS

In the year 1930, the extensive areas of Crown land forests in the four western provinces previously administered by the Dominion Government, were transferred, with other natural resources, to the ownership and control of the respective provinces. Throughout the Dominion, therefore, the forests within each province are now under provincial jurisdiction. The Dominion Government remains charged with control of the forests in the Yukon and Northwest Territories, on the five million acres of the Indian Reserves, and in the various National Parks.

In general, the system of granting cutting licences rather than selling the timberland outright has been followed by all the forest authorities; only in the Maritime Provinces has any large proportion of the forest land been permanently alienated. By the licence system, the Crown retains the ownership of the land and control of the cutting operations and derives revenue in the form of ground-rent, stumpage bonuses, and royalty on the timber cut. Most of the licences are renewable annually at the discretion of the Government and on such terms as may be fixed from time to time, though some are fixed for a definite period. In practice, however, the regulations are changed infrequently and only when justified by the conditions of the timber-using industries.



Forest Services are maintained by all of the provinces except Prince Edward Island. The Dominion Forest Service, Department of the Interior, is now chiefly concerned with the broad subjects of forest research, forest economics, and forest utilization, in all their bearings. Its activities are for the most part carried on in close co-operation with provincial forest authorities and the wood-using industries. With the exception of Quebec, where a separate fire-protection organization exists, each provincial Forest Service has charge of protection from fire, reforestation, and forest research. Except in Ontario, where, as mentioned, a separate "Timber Administration Branch" controls the sale of Crown timber, the Provincial Forest Services have complete control of the Crown forests in the respective provinces.

The administrative methods pursued by each forest authority are more fully described under the headings of Legislation, Assistance to Forestry, and Forest Authorities.

### C.—SUMMARY OF ASSISTANCE GIVEN FORESTRY

#### DOMINION

The Dominion Government, through the Department of Agriculture, provides free nursery stock to farmers and ranchers in the three Prairie Provinces. About 7,000,000 trees or cuttings are distributed annually. Inspectors of tree plantations personally visit intending planters and advise as to the location of the plantation, preparation of the soil, selection and arrangement of the species of trees, and the subsequent cultivation and care. Lectures on tree planting and horticulture are given.

The Research Division and the Economics Division of the Dominion Forest Service, Department of the Interior, co-operate with provincial governments and timber owners and licensees in conducting silvicultural experiments and studies in forest economics. The Economics Division co-operates with the Department of Trade and Commerce and trade associations in matters pertaining to the promotion of trade in forest products. The Dominion Forest Products Laboratories, in addition to the pure research work carried on, investigate many special industrial problems, at the request of the wood-using industries.

A substantial grant is given annually to the Canadian Forestry Association, to assist in obtaining publicity needed in the interests of forest conservation in Canada.

#### BRITISH COLUMBIA

No provision is made for direct assistance in forestry to private owners of timberland, but advice is given where requested.

The "Forest Act," Section 21A, provides for operating pulp units on a sustained-yield basis, and the reservation of Crown timber for use of operators of pulp units who agree to manage their units on working-plan regulations approved by the Minister of Lands.

General provisions of the "Taxation Act" give timberland a preferred rate over wild land. A grant is made to the Canadian Forestry Association for publicity purposes.

#### ALBERTA

An area in the Kananaskis valley has been turned over to the Dominion Forest Service, as a Forest Experiment Station. Tree nurseries are being developed at Oliver, near Edmonton, for the purpose of giving farmers a source of supply supplementary to that obtainable from the Dominion Tree Planting Stations.

#### SASKATCHEWAN

A limited amount of nursery stock is furnished to citizens of the province. A grant is made to the Canadian Forestry Association.

#### MANITOBA

The Province is co-operating with the Dominion Forest Service, by making available an area on the Duck Mountain Forest Reserve for the establishment of a Forest Experiment Station.

#### ONTARIO

The Department of Lands and Forests provides assistance, which in the past has been from educational motives, by providing free nursery stock to individuals, planting up municipally owned demonstration forests, co-operating in definite reforestation projects, examination of private woodlots, giving expert advice, inspection of plantations, and by grants to societies.

*Provision of Nursery Stock.*—Trees are distributed to private landowners for planting projects. The applicant may receive 3,500 trees free by paying the carrying charges to his nearest railway station. Quantities beyond this are charged for at a nominal price. About 7,000,000 trees are sent out annually in connection with this project.

*County Reforestation Projects.*—The older-settled part of Ontario has relatively large areas of waste sandy soil located through the strictly farming section. These have been alienated from the Crown in early days and comprise at least 200,000 acres. The Counties Reforestation Act provides machinery by which such areas may be purchased locally and utilized definitely for growing timber supplies. The county purchases at least 1,000 acres in



one block and enters into agreement with the Department for its development. The Department undertakes to reforest the property, look after its further management, and to turn it over to the county at any time on payment of the expenditure incurred. Up to the present nine counties have availed themselves of this arrangement.

*Municipal Demonstration Forests.*—These are projects undertaken by the smaller municipalities, such as townships, towns, or villages. The municipality purchases the land, usually from 5 acres up to a few hundred acres in extent, and the Department plants the area free of charge, while the care and maintenance devolves upon the local authorities. One hundred and eight municipalities have undertaken these projects and last season this work required over 239,000 trees.

*Taxation.*—The Municipal Act requires the exemption of woodlands from taxation up to 10 per cent of the owners' holdings and not exceeding 20 acres of any single owner. This requires the owner to make application for such exemption.

*Expert Advice.*—Private woodlands and plantations are examined on application, and silvicultural treatment outlined, including pathological conditions.

*Grants to Societies.*—An annual grant is made to the Canadian Forestry Association.

#### QUEBEC

A Forestry Nursery, established at Berthierville in 1908, serves as a demonstration station for the School of Surveying and Forestry and also for the Forest Ranger School. It provides planting material for distribution and sale to private owners of forest land, to educational bodies, towns, etc. It also enables the Government to make some objective plantations, such as the reclamation of shifting sands. Tree seed is collected throughout the province, and an extraction plant is located at the nursery. The capacity of the nursery has been raised to ten million trees, as the demand for trees is developing rapidly.

Expert advice is given by members of the staff on forestry problems that are submitted to the Department, and an annual grant is made to the Canadian Forestry Association.

The School of Forestry and Surveying at Laval University in the City of Quebec was established and is supported by the provincial Government. Other schools for the training of forest rangers and paper-makers are maintained.

Provision is made by legislation for the creation of township communal forests, and settlers and others are encouraged and assisted to devote a part of their holdings to timber production. For each acre of land planted with forest trees the owner is entitled to a bounty of \$10 after five years.

#### NEW BRUNSWICK

Technical advice is given to timberland owners or licensees. The province makes an annual grant to the Canadian Forestry Association. Active co-operation is maintained with the Dominion Forest Service, Department of the Interior, and the Entomological and the Plant Pathology services of the federal Department of Agriculture.

In 1934 the New Brunswick government transferred to the Dominion 35 square miles near Fredericton, to be used as a Forestry Experimental Area.

#### NOVA SCOTIA

Nursery stock is provided free of cost to any citizen of the province upon application, from the provincial forest nursery. The Chief Forester is available to any citizen of the province who may require his services for expert advice. The provincial Government is assisting the Canadian Forestry Association with an annual grant.

## 7—Forest Authorities

#### DOMINION

Previous to the year 1930 the Dominion Government, through the various branches of the Department of the Interior, administered the Crown lands in the provinces of Manitoba, Saskatchewan, and Alberta, and in portions of British Columbia. In that year, however, under the terms of the Natural Resources Acts, these lands and forests, in common with the other resources, were transferred to the ownership and control of the respective provinces. This action left the National Parks of Canada and, of course, the extensive Crown lands embraced in the Yukon and Northwest Territories, still under federal jurisdiction.

The forests on federal lands are now administered by two branches of the Department of the Interior, namely, the Lands, Northwest Territories and Yukon Branch and the National Parks of Canada Service.

Indian reserves, which are distributed throughout the Dominion and comprise 7,694 square miles, of which approximately 4,000 square miles are wooded, are administered in trust for the Indians by the Department of Indian Affairs.

The Board of Railway Commissioners for Canada has charge of the fire protection along the railway lines subject to its jurisdiction. These various authorities will be described separately.



*Forest Service, Department of the Interior*

The chief activities of the Forest Service now lie in the broad fields of silvicultural and forest-products research and forest economics, throughout the Dominion. The Forest Service also conducts surveys of forest resources and studies of industrial problems which from time to time confront forest administrators or the wood-using industries. These are conducted either as independent studies or in co-operation with provincial authorities or such concerns as the lumber companies and the pulp and paper companies. Another phase of Forest Service work lies in intensive study of the many important problems arising in effective fire protection, such as the accurate forecasting of fire-hazard weather.

The head office is in Ottawa, and district offices are maintained in Winnipeg, Manitoba; Calgary, Alberta; Vancouver, British Columbia; and Fredericton, New Brunswick—each having two or more trained foresters. The staff at head office consists of the Director of Forestry, Associate Director, seventeen technically trained foresters or engineers, and a clerical personnel. There are five divisions, namely, research, economics, protection, engineering, and the Forest Products Laboratories.

*Silvicultural Research.*—Studies of the silvicultural characteristics of the various species, and the rate of growth and the best practicable means of securing sustained yields of the most valuable species are being conducted at various points in Canada where forest experiment stations have been established. The development of methods of measuring standing timber and growth comes under this division. In co-operation with the provincial forest services five experiment stations have now been located.

*Forest Economics.*—In nearly all phases of forestry work the economic factor is usually, in the long run, the basic and governing consideration. In past years the division of forest economics has been concerned primarily with making studies and conducting surveys in respect to the forest resources of Canada. This has involved the collection, compilation, and revision from time to time of all available information concerning this resource.

The major project of this nature now in hand, which is proceeding in co-operation with the various provinces, is the national forest inventory, begun in 1929. This general survey, not merely of the existing stand but of the factors of growth and depletion as well, will provide data required for the framing of broad policies for the administration of the forests. The development of aerophotographic surveys as applied to forests has been an important feature of the work of this Division. Methods have been devised for measuring the height of the trees in both vertical and oblique photographs and for the volumetric estimates of the stands. The various factors affecting forest depletion such as utilization, fire, insects, and decay are studied and appraised. At the present time a field project is being conducted at the Petawawa Experiment Station, aimed at control of the white-pine blister rust on that area. In collaboration with the Dominion Bureau of Statistics, information concerning the production of the wood-using industries and the domestic and foreign trade in forest products is compiled and tabulated with the object of developing industry and trade.

Among the co-operative economic projects which are planned for the near future are cost studies in connection with logging on a silvicultural basis.

*Forest-products Research.*—Three laboratories for conducting forest-products research are maintained. The main laboratory is in Ottawa, where timber testing, timber physics, wood pathology, and wood preservation are studied. The Pulp and Paper Division is located in Montreal, and is carried on in co-operation with the Canadian Pulp and Paper Association. A branch laboratory at Vancouver, British Columbia, specializes in western problems. These laboratories investigate the physical and chemical properties of the various species of wood and their adaptability to industrial use, the most economical and efficient methods of manufacture and utilization, the elimination of waste, and the prevention of decay.

*Recruitment and Training.*—All appointments to the Forest Service, except those of labourers and temporary patrolmen who are employed for less than six months, are made by the Civil Service Commission. Vacancies are advertised publicly, and applications, giving full details, are submitted by the applicants. When considered necessary, competitive examinations, partly oral and partly written, are held at convenient points. Applicants must be British subjects and residents of Canada for at least three years. Technical foresters are required to have graduated from a course in forestry at a college or university of recognized standing, or to have had equivalent training and experience. In the Forest Service they are recruited for the most part from the Canadian universities. Permanent non-technical field employees are required to have had practical experience in work connected with forestry or some forest industry, to have good physique and education sufficient to enable them to carry on the ordinary administrative work of the Service, keep records, and make the necessary reports. Undergraduates in forestry are given employment on surveys during their summer vacations, and thereby acquire valuable practical experience.

*Publications and Reports.*—The Director of Forestry publishes an annual report dealing with the various phases of the work of the Service. Bulletins of a technical, popular, or educative nature are published from time to time.

From 1908 to 1917, the Forestry Branch of the Department of the Interior (now known as the Forest Service) published annual reports on the production of the lumber and pulp and paper industries, and special reports on other forest products. Since 1917, the collection and publication of these forest-products statistics has been carried on by the Bureau of Statistics, Department of Trade and Commerce, in co-operation with the Forest Service.



A list of publications available for distribution by the Forest Service will be found in the Appendix.

*Income and Expenditure.*—Previous to the year 1930 the Forest Service exercised extensive administrative duties involving a considerable annual expenditure and revenue. It has now become, however, an organization charged primarily with the study of problems in silviculture, forest economies, forest protection, and the utilization of forest products. Its only source of income lies in the annual appropriation made for this investigative work, which during the four-year period 1932 to 1935 has averaged \$293,000 yearly.

#### *National Parks of Canada Service*

The National Parks of Canada are eighteen in number and cover an area of 12,059 square miles. Nine of these reserves are scenic parks, four are animal parks, three are recreational parks, and two national historic parks. Seven are situated in Alberta, four in British Columbia, one in Saskatchewan, one in Manitoba, three in Ontario, one in New Brunswick, and one in Nova Scotia.

These national reservations were set aside by Act of Parliament and dedicated to the people of Canada for their benefit, education, and enjoyment. All natural resources are conserved within these areas; land in the Park townsites is leased but not sold; development is subject to government supervision; wild animal and plant life is rigidly protected by the Parks administration through resident superintendents and staffs. Fishing in the parks is permitted in certain seasons, but hunting is absolutely forbidden. All visitors carrying firearms must have them sealed on entry, and they must remain sealed until departure from the park.

Jasper National Park, with an area of 4,200 square miles, is the largest national park in Canada, although Banff National Park, with headquarters at Banff, and an area of 2,585 square miles, is the oldest. Both are famous as holiday resorts, Banff being also noted as a winter sports centre. Kootenay National Park is a scenic reserve bordering the Banff-Windermere Highway. Yoho, Glacier, Mount Revelstoke, and Waterton Lakes National Parks are all mountain playgrounds possessing some of the most magnificent scenery to be found in the world. Banff, Yoho, and Kootenay Parks are linked by a system of highways including the Banff-Lake Louise highway, the Banff-Windermere highway, and the Kicking Horse Trail. The latter two transmontane motorways cross the central Rockies.

Buffalo and Elk Island National Parks are animal parks containing buffalo, deer, elk, and moose. At present there are approximately 5,000 buffalo in the Buffalo Park and 2,000 in Elk Island Park. Nemiskam Park is an antelope reserve, where Canada's efforts in the conservation and propagation of this animal have been very successful. The herd now numbers 340.

Five hundred and fifty-four miles of first-class motor roads are at present in use within the parks. A total trail mileage of 2,753 is maintained, by which many points of interest are made accessible to visitors, and the warden service is aided in game patrol and fire-protection duties. Telephone lines totalling 1,094 miles have been built, which include the systems in townsites and the forest lines used by wardens.

Prince Albert Park, Saskatchewan, established in 1928, has an area of 1,869 square miles and contains some of the finest recreational and scenic territory to be found in the province. The Riding Mountain National Park in Manitoba was established in 1929. It comprises 1,148 square miles of elevated, rolling woodland, with several fine lakes, and manifold facilities for camping, recreation, and sport. In Ontario, Point Pelee Park is a bird sanctuary and recreational area, and the St. Lawrence Islands Park and Georgian Bay Islands Park are maintained for recreational purposes. The two parks in the Maritime Provinces, Fort Anne Park and Fort Beauséjour Park, are national historic parks.

#### *Board of Railway Commissioners*

*Fire Inspection Department.*—Ninety-seven per cent of the 41,776 miles of steam railway in Canada is subject to the jurisdiction of the Board of Railway Commissioners. Lines not so subject are those operated under Provincial charters, or owned and operated by a Provincial Government under other than a Dominion charter.

On railway lines subject to the Board's jurisdiction, the measures to be taken by the companies for the prevention and control of fires presumably due to railway agencies are prescribed in the Railway Act and in General Order No. 362 of the Board. These requirements are, briefly, as follows:

(a) Railway rights of way must be maintained free from all unnecessary combustible matter. Cuttings, dry grass, and other inflammable debris are generally burned early in the spring or late in the fall. The time when fire may be used for this purpose and the precautions to be taken to prevent its spread are regulated by local officers of the Fire Inspection Department of the Board, by the issuance of permits to burn. Such local officers may prohibit all burning operations when weather conditions render the use of fire unsafe. Ordinarily, railway rights of way are 100 feet in width, that is, 50 feet on each side of the centre of the main track. On a comparatively small mileage, the right of way is double this width. Steady progress is being made towards better conditions on rights of way through forest sections. The effectiveness of this work is greatly reduced by the presence of logging slash and other inflammable debris on lands immediately adjoining rights of way. This constitutes a very serious problem in the



control of fires originating on or near the railways. A beginning toward the solution of this problem on outside lands has been accomplished, through Provincial Forest Services, acting under Provincial legislation.

(b) Efficient spark arresters and other fire-protective appliances must be maintained on all coal-burning locomotives. Railways are required to make weekly inspections of such appliances and to hold defective locomotives out of service until repairs have been made. Intensive check inspections of fire-protective appliances are made by the Board's Inspectors.

(c) The dumping of fire, live coals, and hot ashes upon the right of way is prohibited unless the burning material is immediately extinguished.

(d) The use of dangerous classes of locomotive fuel is prohibited unless locomotives are equipped with special spark-arresting devices approved by the Board.

(e) To reduce the danger of fires being set along the railway, by burning smoking-materials thrown by passengers from trains, railways are required to post warning notices in cars where smoking is permitted, and trainmen issue verbal warnings to passengers in addition.

(f) The danger of fires in prairie sections of the Prairie Provinces is greatly reduced by the ploughing of fireguards along railway lines in accordance with requirements prescribed by the Chief Fire Inspector of the Board. During 1934 approximately 5,600 miles of fire guards were maintained in uncultivated lands.

(g) The Chief Fire Inspector is authorized to prescribe the establishment of special fire patrols by railway companies through forest sections. Under this requirement, the services of 1,055 special fire patrolmen in railway employ are available when required, on some 7,700 miles of line where the fire-hazard is high. On 6,576 additional miles of line through forested territory where the fire-hazard is not extreme, fire-protection work is handled by section forces and other employees, as a part of their regular duties.

(h) Railway companies are required to instruct section-men, agents, contractors, trainmen, and other regular employees relative to the reporting and extinguishing of fires occurring within 300 feet of the track, unless proof shall be furnished that such fires were not caused by the railway.

(i) Each railway company is required to submit a report to the Board with respect to every fire which burns over more than 100 square feet outside the right of way in what is classified as a forest section. These reports are checked and supplemented by reports from officers of the Fire Inspection Department.

The fire-protection work of the railway companies is supervised by the field staff of the Fire Inspection Department of the Board. This staff is not a special set of men employed by the Board, but is made up of approximately 184 employees of the various forestry and fire-protective organizations of the Dominion and Provincial Governments, such employees being appointed officers of the Board under a co-operative arrangement established immediately after the issuance of the Board's fire regulations in 1912. This plan has for the most part worked out admirably. The railway companies have, with few exceptions, co-operated efficiently, and the fire loss due to railway causes has decreased to such an extent that the railways have now become minor, instead of major, agencies in causing loss by forest fires. In many cases, the railways have been effective in checking fires which came from a distance, and for the origin of which they were in no wise responsible.

During the 10-year period, 1925 to 1934 inclusive, the railways were charged with 12 per cent of the total number of fires reported as occurring in forest territory. Of these, a large proportion were only incipient and caused no damage. Fires attributed to railway agencies during this period accounted for only 4.5 per cent of the total area burned over by fires due to all causes throughout the Dominion.

#### BRITISH COLUMBIA

The Department of Lands, under the Minister of Lands and the Deputy Minister of that department, administers the natural resources of this province in connection with provincial land, forest, and water. The Forest Branch, as a part of this Department, is the Forest Authority of the province. This branch, under a Chief Forester and Assistant Chief Forester, has seven main divisions, namely, Management, Operation, Research, Forest Surveys, Grazing, Finance, and Trade Extension. Each division is normally in charge of a superior officer with the necessary technical and clerical personnel.

The above organization, with headquarters at Victoria, has under its direction a permanent staff of nearly 200 scattered throughout the six forest districts into which the province has been divided for the purpose of administration. Each district is in charge of a District Forester and an Assistant District Forester, under whom works a staff of rangers and others. In the fire season about 400 temporary assistant rangers, patrolmen, and lookout men are employed in addition.

Technical foresters are required to be graduates of recognized forest schools. Undergraduates are given summer employment wherever possible.

The ranging and scaling staff are selected by competitive examinations under the Civil Service Commissioner. Assistant rangers must pass a special departmental examination, where experience in woods work and physical fitness are among the qualifications required. Co-operation with industries and development of policies are assisted by advisory joint committees on the export of raw materials, the scaling of timber, and the protection of the forests from fire.

The main efforts of the Forest Branch have been directed towards the protection of the forests from fire and the business administration of the forests, but research work is now being conducted as funds and trained men become available. In 1927 a Research Division was organized and two Forest Experiment Stations established. Work bearing on various problems has



been carried on during the interval, though regrettably restricted in recent years. An active policy of forest-land reservation has been followed, so that British Columbia has now 22,500 square miles of Provincial Forests.

*Income and Expenditure.*—During the five years, 1929 to 1933, the total income from the forests, including the various special funds, averaged \$3,171,000, and the expenditure \$1,279,000.

#### ALBERTA

Administration of the forests of Alberta is carried on by the Provincial Forest Service, which has complete control of the Forest Reserves, and is responsible for fire protection in all provincial forests. The Provincial Lands Administration at first controlled the disposal of timber lying outside the Reserves, but this responsibility has now been given to the Forest Service.

The Forest Service is headed by the Director of Forestry, whose principal assistants are the Assistant Director, and the Chief Timber Inspector. The province is divided into twelve forest districts, four of which contain Forest Reserves and are administered by forest superintendents, the remainder being in the charge of timber inspectors. The remainder of the field staff consists of five permanent rangers, ninety-one seasonal rangers and assistant rangers, nineteen seasonal lookout and patrol men, and three telephone operators.

*Timber Disposal.*—Timber is disposed of by sale and permit on the Forest Reserves, and by permits and berths on outside Crown lands. Competition is required, except in the case of permits.

*Forest Protection.*—The protective organization is controlled by the Forest Superintendents and Timber Inspectors in their respective districts, general supervision being given by the Assistant Director of Forestry. As the conditions in Alberta are not considered suitable for the use of aircraft, dependence for detection is placed in a series of lookout cabins and towers, supplemented by ground or river patrols.

During 1931 to 1933 the average annual revenue from the forests was approximately \$153,000 and the expenditure \$200,000.

#### SASKATCHEWAN

Forests of the province are administered by the Department of Natural Resources. The Deputy Minister, who manages the Department, is advised and assisted with respect to forestry matters by the Director of Forests. There is no separate forest service, but there are other officers, including the Supervisor of Fire Protection, and an officer concerned with timber disposal, whose time is given solely to forest affairs. Field officers of the Department are required to attend to all natural resources within their districts, including forests, both inside and outside Forest Reserves.

There are three district offices, in addition to the head office, and the province is divided into forty-eight field divisions, in each of which there is at least one resident officer of the Department.

*Timber Disposal.*—Timber is disposed of through permits, timber berths, and timber sales. Local officers are enabled to issue permits to settlers for small quantities of wood, while more important transactions are referred to the district office or to head office.

*Fire Protection.*—The organization of all fire-protection measures is under the control of the Supervisor. The permanent field staff is augmented during the fire season by temporary employees, who carry out patrols, man lookout towers, and perform other like services. The system of lookouts is made effective by an excellent system of radio communication. In addition to the four principal stations, there are a number of portable sets, capable of receiving by telephony and sending telegraphically, which are distributed at strategic points. These small sets are easily transported to fires by aircraft or otherwise, and make it possible to have communication with the central authorities.

Aircraft and flying personnel were previously obtained from a commercial company by contract, but in 1934 the province undertook its own aerial work. Five aircraft were maintained by a staff consisting of two pilots and one pilot air engineer. The machines are used both for detection and suppression, and aerial transportation is furnished to other governmental services.

*Reforestation.*—Two nurseries are maintained on Forest Reserves, and two more on Provincial Parks. Three other small nurseries are being cared for temporarily.

During 1931-33 the average annual revenue from the forests was about \$143,000, and the expenditure for forestry purposes \$129,000.

#### MANITOBA

Forest administration is under the Minister of Mines and Natural Resources. The Forest Service is headed by the Provincial Forester. Head-office staff consists of a Timber Sales Officer, a Senior Forest Engineer, and a clerical staff.

The province is divided into four districts, each of which is under the charge of a District Forester. The permanent field staff consists of one forester, twenty-five forest rangers, and one pigeon-loft man. There are also thirty-three temporary and seasonal employees.

The Manitoba Government Air Service is also under the direction of the Provincial Forester. Five pilots and three air engineers are employed, and there are five aircraft in service, which are used for other branches of the government service as well as forestry.



*Timber Disposal.*—Permits, both free and paid, are issued for small quantities of wood. Timber berths may be obtained. The favoured system of disposal is the short-term timber sale.

*Forest Protection.*—The air service is used primarily for the detection and suppression of fires in the east and north. The number of look-out towers has been increased to thirty-five. Communication with accessible towers is by telephone; for the more remote ones carrier pigeons are used. Protection operations are directed by the District Foresters.

*Reforestation.*—Four small nurseries are operated on Forest Reserves, producing both native and exotic species.

For the years 1931 to 1933 the average annual revenue was about \$101,000 and the expenditure \$157,000.

#### ONTARIO

The Department of Lands and Forests is presided over by a Minister and a Deputy Minister. The Department is subdivided into four divisions, or branches, namely, Lands, Land Surveys, Timber Administration, and Forestry.

Forest administration is carried out through the Timber Administration Branch, controlling timber sales, with methods of cutting and inspection. The Forestry Branch has charge of reforestation, protection, forest surveys and research.

The Timber Administration Branch is directly under the Deputy Minister of the Department. The work undertaken involves the granting of timber licences, scaling of timber cut, collection of revenues, inspection of logging operations, dealing with trespass cases, and adjusting the timber rights of settlers. A considerable field staff of Crown Timber Agents and Licensed Timber Scalers is required to carry out these duties.

At the time of writing the forest administration is being reorganized, and it is expected that the field operations of protection and administration will be to a large extent combined.

The Forestry Branch is headed by a Provincial Forester, and under him at head office are four Foresters, in charge of different divisions of the work, and several assistant foresters.

*Forest Protection.*—A patrol system was inaugurated in 1885, and has been gradually developed until Ontario has one of the best organized and equipped protection services on the continent. The main features of the system are the establishment of a close season, during which permits are required for setting out fires and for travel in the forest; aerial patrol by the Provincial Air Service; ground patrol by 900 rangers provided with means of transportation such as motor boats, motor trucks, railway speeders, and canoes, and with portable power and hand pumps, hose, shovels, and other equipment; a system of 234 lookout towers with telephone connections; inspection of locomotives, and publicity.

For protective and administrative purposes the northern or forest region of the province is divided into 12 districts, having an aggregate area of 102,340,000 acres. The supervisory field staff in charge consists of 12 district foresters and forest assistants, 30 chief fire rangers, and a personnel of deputy chief rangers, rangers, lookout men, and others. In 1934 the protection force on duty averaged 900 during the summer months.

*Reforestation.*—Three Provincial Forest Stations have been established in the southern portion of Ontario for the production of nursery stock and the development of demonstration plantations and forests. At St. Williams, in Norfolk county, is the oldest forest nursery station, consisting of 3,300 acres (established in 1909). The nursery portion of this station comprises 140 acres, the remainder being natural woodlands and demonstration plantations. The principal species used are white, red, jack, and Scotch pines, white and Norway spruce, and European larch. In 1922, two new stations were established along the above lines, one of 150 acres at Orono in Durham county, and the other of 1,200 acres at Midhurst in Simcoe county. These provincial forest stations have at present a capacity of over 12,000,000 plants.

Demonstration plantations are being made through the northern districts on denuded Crown lands. Last season 26,000 trees were planted in the vicinity of ranger stations. Reforestation on private and municipal projects is assisted. The rapid development of reforestation has presented the problem of securing forest-tree seed. To meet this demand a curing and extracting plant has been established at Angus, Ontario. At this point the Department maintains drying sheds with a capacity of 10,000 bushels of cones and a storage vault capable of holding 25,000 pounds of seed.

During the season of 1934, 3,245 bushels of cones (conifers) and 1,388 bushels of seeds (hardwoods) were collected over the province.

*Forest Surveys.*—In 1931 a bulletin with maps was published entitled "The Forest Resources of Ontario." This brought together the data gathered on field surveys during the preceding twelve years. This field work covered 73,000,000 acres, and on this basis a general description of the forests of the province is built up. Briefly, the report shows a total forest area of 110,000,000 acres; of this area approximately one-fifth is of coniferous type, an equal area is in hardwoods, and the remainder is mixed.

The average annual revenue from the forests during the years 1929 to 1933 was about \$2,724,000 and the expenditure \$2,638,000.

A Forestry Board, which was created by legislation in 1926, functions in an advisory capacity. It is composed of five members, three representing the forest industries, one the Faculty of Forestry at the University of Toronto, and the Provincial Forester. It is essentially a fact-finding body with respect to the forestry problems of the province.



## QUEBEC

*Forest Service.*—The Department of Lands and Forests of the provincial Government administers the timber in the province. In 1909, a Forest Service was created in this Department and given charge of the timber lands and matters relating to forestry. It is organized under the Chief of the Forest Service and the Assistant Chief. The staff consists of forty-five forest engineers and a non-technical field force of 255 rangers and cullers. The Forest Service has charge of the exploration of unsurveyed territory in the province, the classification of soils, the supervision of lumbering operations on Crown lands, reforestation, and all other technical work of the Department in connection with forests. The School of Forestry, the School of Forest Rangers, and the School of Paper-making are supported by the Forest Service.

*Forest Protection Service.*—In 1924 the Government instituted a special Forest Protection Service to take charge of fire protection and suppression. This Service patrols the Crown lands, the Provincial Parks, and all the private lots of the settlers, and has supervision over the protection on licensed lands. Every licensee is required from early spring to late fall to have his limits patrolled by a competent staff of rangers, paid and selected by him, but appointed by the Minister of Lands and Forests, and the latter may prescribe the necessary personnel.

Since 1913, many timber-limit holders in three districts have formed associations for the purpose of securing an adequate protection against forest fires, but some large timber companies maintain their own patrol. These licensees and the associations conduct their protection operations on a co-operative basis with the Forest Protection Service. Every year they must submit their plans of organization to the Forest Protection Service for approval.

For forest-protection purposes, the province has been divided into eleven districts. The fire-fighting force numbers not less than 4,000 inspectors and rangers every year. The Chief and Assistant Chief of the Forest Protection Service are the authorized representatives of the Board of Railway Commissioners and of the Public Utilities Service.

A close season is established between April 1 and November 15, during which permits must be secured for slash-burning all over the province. Legislation has been passed requiring all persons who wish to travel in the forest between April 1 and November 15 to secure permits issued by the Forest Protection Service.

Thirty-nine Meteorological Stations have been equipped to study relative humidity and its relations to forest-fire hazards, eleven of these in co-operation with the Dominion Meteorological Service.

The activities of the Forest Protection Service include the extension of telephone lines throughout the forests, the organization of patrols, the construction of trails through the forests, the installation of permanent lookouts, and the issuing of permits for burning and travel in the forests. Press campaigns and lecture tours are conducted in co-operation with the Canadian Forestry Association. Thousands of posters are posted at appropriate places, and a special calendar of the Department of Lands and Forests is distributed throughout the province. Aerial patrol is conducted from a hydroplane station at Roberval in the Lake St. John district.

The average annual revenue from the forests in Quebec during 1929-33 was about \$3,650,000 and the expenditure \$2,311,000.

The recruitment and training of superior officers is through the School of Forestry, which is affiliated with Laval University. Students of the school are employed during the summer months. Rangers and cullers are appointed on practical qualifications with statutory examination in some cases. Additional training is afforded by the School of Forest Rangers.

The Minister of the Department publishes an Annual Report containing the Report of the Chief of the Forest Service. The provincial Bureau of Statistics publishes a Statistical Year Book containing forest statistics and information concerning provincial forestry matters furnished by the Forest Service.

## NEW BRUNSWICK

The forest administration is under the Minister of Lands and Mines. The Deputy Minister, who is the permanent head of the Department, is a graduate of the New Brunswick Forest School and was formerly Chief Forester. The Forest Service has charge of the administration of the forests on Crown lands, fire protection, and the fish and game in the forests. The head-office staff consists of a Chief Forester, Assistant Forester, Chief Game Warden, Chief Scaler, and Forestry Assistants. Control of game protection, measurement of timber, and fire protection is carried on by a permanent staff of forest rangers supplemented by seasonal game wardens, scalers, patrolmen, and lookout observers.

The forest is one of the chief sources of revenue in New Brunswick. During 1929 to 1933 the average annual revenue from the forests, including game, in New Brunswick, was approximately \$796,000, and the expenditure \$88,000.

The New Brunswick and Nova Scotia forest services are the only forest authorities in Canada which have control of the fish and game and include these resources in their revenues and expenditures. Exclusive of game and fish, the forests yield New Brunswick an annual revenue of about \$634,000.

## NOVA SCOTIA

The Attorney-General of the province is also the Minister of Lands and Forests, and is responsible for the management, leasing, sale, or other disposition of the Crown lands, the surveying and recording of all forest and wild lands, the conservation and protection of all forest and timber lands—whether Crown lands or privately owned—and the protection, preservation, and propagation of game and game fish.



Under the Minister, the Chief Forester has charge of the forest protection, surveying, and scaling.

The province is divided into twenty chief-forest-ranger districts, each district comprising about 1,200 square miles. The Chief Forest Rangers are experienced woodsmen who, for a number of years, have been occupied in the lumbering business as superintendents and chief scalers. During their term of office they receive considerable training in surveying, cruising, and general forestry.

Each Chief Ranger District is divided into an average of three ranger districts, each comprising about 400 square miles. The rangers are practical woodsmen, recruited from the ranks of camp foremen, scalers, or guides. This permanent ranger force is reinforced by nearly two thousand voluntary fire guardians, scattered throughout the province. These men have telephones and co-operate with the rangers, but are paid only when fighting fires.

The Department operates a forest nursery at Lawrencetown, which in 1934 provided free to woodlot owners and schools a total of 82,000 trees. Because of the excellent natural reproduction, however, planting is likely to remain a factor of minor importance.

The Department issues an annual report and has published a number of circulars or bulletins dealing especially with the improvement of farm woodlots and the teaching of elementary forestry principles in the schools.

*Revenue and Expenditure.*—Owing to the small proportion of the forest land which has not been alienated, the direct forest revenue is relatively small, compared with that of the other provinces. During 1929 to 1933, including game, it averaged about \$178,000, while the expenditures were about \$119,000. The strictly forest revenue was about \$134,000.

FOREST REVENUE AND EXPENDITURE IN CANADA

The various governments in Canada, Dominion and Provincial, are securing under the present conditions a direct annual revenue of about \$10,915,000. This is considerably below normal on account of the reduction in amount of timber cut and also in the stumpage dues. The total expenditure is about \$7,234,000, about half of which is spent on fire protection and 30 per cent on administration.

Though it is impossible to accurately segregate all the items of revenue and expenditure, an attempt has been made in the summary tables given below to show the relative importance of the various sources of revenue and the distribution of expenditures in five main classes. The figures are based on the average during the five years 1929 to 1933, except in the case of the Dominion and the three Prairie Provinces where the transfer of the resources in 1930 necessitated use of only the 1932 and 1933 fiscal years.

Revenue		Expenditure	
Stumpage, Royalty, and Bonus.....	\$ 7,820,000	Administration .....	\$ 2,114,000
Ground Rental and Licence Fees.....	1,479,000	Investigation and Research.....	880,000
Penalties, Interest, Etc.....	136,000	Fire Protection .....	3,662,000
Scaling Fees .....	109,000	Reforestation .....	468,000
Taxation of Private Forest Lands....	522,000	Trade Extension, Etc.....	110,000
Forest Protection Tax.....	551,000		
Grazing and Hay.....	32,000		
Wild Life (N.S. and N.B. only).....	206,000		
Miscellaneous .....	76,000		
Total .....	10,931,000	Total .....	\$ 7,234,000

Authority	Revenue	Expenditure
	\$	\$
Nova Scotia.....	178,000	119,000
New Brunswick.....	796,000	88,000
Quebec.....	3,650,000	2,311,000
Ontario.....	2,724,000	2,638,000
Manitoba.....	101,000	157,000
Saskatchewan.....	143,000	129,000
Alberta.....	153,000	200,000
British Columbia.....	3,171,000	1,277,000
Dominion Forest Service.....	15,000	315,000
Total for Canada.....	10,931,000	7,234,000

In Nova Scotia and New Brunswick the expenditure for the protection and administration of the wild life is combined with that for strictly forestry purposes, and it was necessary therefore to include the revenue from that source. The contributions of the timber owners towards fire protection are included in the revenue, except in the province of Quebec, where for the most part they provide their own protection through their Protective Associations. These associations spend about \$475,000 annually in protecting the limits of their members. The railway companies also spend a large amount in protecting the forests along their lines, and a great many of the larger companies supplement the regular services by maintaining equipment and patrols. Approximately \$100,000 is spent on forest fire protection in the National Parks. Altogether, about \$4,500,000 is spent annually on protecting the forests from fire. The Dominion Department of Agriculture devotes about \$75,000 to forest-insect investigation and control and \$7,500 to forest pathology. Including education and all governmental and private expenditures, the annual expenditure on forestry in Canada exceeds \$8,000,000.



## 8—Municipal and Private Forestry Activities

The abundance of cheap and accessible timber and the conditions of tenure under which over 90 per cent of the forest land is owned by the Crown in the right of the Provincial Governments or the Dominion have been retarding factors in the development of municipal and private forestry in Canada.

In the settled districts of Eastern Canada nearly all of the farms have woodlots, which supply a large proportion of the fuel used by the rural population. They yield also a considerable amount of timber for construction purposes and the wood-using industries. Maple sugar and syrup are also important products of these woodlots. The 1931 census showed that the forest products of the farms had an annual value of \$48,000,000. The indirect benefits of these forests to agriculture in the conservation of water, protection to stock and crops from the sun and wind, and the amelioration of climatic extremes are undoubtedly of greater value even than the wood produced. On the whole, however, these woodlots have received very little silvicultural attention and have deteriorated to such an extent that their productiveness is far below what it might be.

The exceptions to this rule have proved that there is no part of the farm which yields a higher financial return with such a small amount of labour and expense. A survey of the fuel situation conducted in the province of Ontario revealed the fact that the districts which had the best-kept woodlots were invariably the most prosperous agriculturally.

For many years, Ontario and Quebec have been encouraging and assisting in the development of farmers' woodlots by furnishing expert advice and providing planting stock, either free or at nominal prices. New Brunswick and Nova Scotia are now following a similar course.

The development of this project in Ontario is indicated by the fact that in 1905, when the distribution of nursery stock was started, 10,000 trees were set out. In 1910 the number had grown to 500,000, and in 1929 had reached 12,750,000. From this peak year the number fell, as a result of the depression, to 9,000,000 in 1934. From the Quebec provincial nurseries in 1934, some 7,350,000 trees were supplied to woodlot owners.

With the assistance of the Forest Service of the province of Ontario, eleven county forests and numerous municipal forests have now been established, and it is expected that the number and size of such communal forests will steadily increase in future years. Moreover, for educational purposes, the Forest Service has established 108 demonstration woodlots adjacent to highways; also 110 demonstration plots of smaller size.

In Quebec, 105 township forests, aggregating 812,591 acres, have been established under the control of the Provincial Forest Service.

In the Prairie Provinces the work of tree planting, which had been conducted by the Dominion Forest Service since 1901, was taken over by the federal Department of Agriculture in 1930, upon the transfer of natural resources. Up to date (that is, since 1901) approximately 145,000,000 seedlings and cuttings have thus been furnished to prairie settlers free of charge. In the year of maximum distribution, 1929, over 8,675,000 trees were supplied to some 7,452 applicants. As a result of a system of inspection and personal advice by Tree Planting Inspectors, these plantations have been remarkably successful, and have done much to improve fruit-growing possibilities and conditions generally around prairie homes. Though the object of the plantations is primarily protection against the wind, many of the older plots are now providing a welcome supply of wood, which is most useful on a prairie farm.

Few of the lumber operators in Canada have as yet attempted much in the way of forestry, beyond fire-protective efforts, but during the decade 1920 to 1930 many of the pulp and paper companies developed forestry departments in charge of technically trained men. For the most part their duties consisted in stock-taking, mapping, and the framing of preliminary working plans. In a number of instances the entire woods operations are now in charge of foresters and efforts towards placing their forests on a sustained-yield basis are being made. A few plantations have been made, but for the most part natural regeneration is depended on.

## 9—Professional and other Societies Interested in Forestry and the Utilization of Forest Products

### PROFESSIONAL

#### CANADIAN SOCIETY OF FOREST ENGINEERS

This is an organization of professional foresters, established in 1908, with the object of promoting the practice of forestry and the interests of the profession. It is divided into four regional groups, and provision is made for the formation of local sections.

In 1935 there are 360 members and the executive officers are: G. C. Piché, Chief of the Quebec Forest Service, Quebec City, president; W. A. Delahey, Maniwaki, Quebec, vice-president; Ellwood Wilson, Knowlton, Quebec, secretary-editor; D. Roy Cameron, Forest Service, Dept. of the Interior, Ottawa, treasurer; Chairmen of the regional groups: W. Ab Yberg, Quebec and Maritimes; F. A. MacDougall, Ontario; George Tunstell, Prairie Provinces; and J. H. Jenkins, British Columbia. The official organ is the *Forestry Chronicle*, which is published quarterly.

#### ASSOCIATION OF FOREST ENGINEERS OF THE PROVINCE OF QUEBEC

This Association was founded in Quebec in 1916, obtained a legal status in March, 1921, and has a total membership of 157 forest engineers.



The objects of this Association are to safeguard public interests concerning the management of the forests in the Province of Quebec; to protect its members against the activities of other persons calling themselves "forest engineers" who have not the scientific training; to establish an esprit-de-corps among its members, and to advance their standing by the discussion and publication of technical works.

The principal officers are: J. O. Wilson, Quebec City, president; G. Maheux, Cimon Building, Quebec City, secretary.

#### GENERAL

##### CANADIAN FORESTRY ASSOCIATION

The Canadian Forestry Association was founded in 1900 as a propagandist organization to stimulate public interest in the forest resources, their protection from fire and rational management. The greater part of the Association's effort has been given to securing popular co-operation in reducing the fire-hazard in the forests and in promoting tree planting on the prairies.

Lecture tours by railway and motor cars equipped with motion picture machines are carried on. Lectures, films, and literature are provided for schools and other organizations. An attractive, popular magazine, *Forest and Outdoors*, is published monthly.

There are approximately 13,000 members. In addition to the membership fees, the Association receives substantial grants from the Dominion and Provincial Governments, the forest industries, and other interests concerned with the conservation of the forests and wild life of the Dominion.

The officers of the Association for 1935 are the following:

Patron: His Excellency, the Governor General  
 Honorary President: Rt. Hon. R. B. Bennett, Prime Minister of Canada  
 Honorary Vice-Pres.: Hon. Thomas G. Murphy, Minister of the Interior  
 President: Henri Kieffer, C.E., F.E., Quebec City  
 Manager: Robson Black, Canada Cement Bldg., Montreal.

#### COMMISSIONS

##### QUEBEC FOREST PRODUCTS COMMISSION

*Head Office:* 55 Grand Allée, Quebec; organized in 1931 and consists of five members.

*Objects.*—To study the economic problems related to a continuous future supply of commercial woods in the province; suggest practical measures to improve the manufacture, grading, and utilization of forest products for home and foreign markets.

*Officers:* Chairman, L. A. Daigle; Vice-Chairman, J. M. Dessureault. The other commissioners are Hon. W. Gerard Power, Quebec City, J. S. Bock, Montreal, and G. C. Piché, Provincial Forester. The latter also acts as Secretary-Treasurer.

##### NEW BRUNSWICK FOREST OPERATIONS COMMISSION

*Head Office:* Fredericton, N.B. Organized, 1934.

*Main Functions.*—To determine equitable minimum wage scales, consider wage claims, and settle labour disputes in the forest industries.

*Officers.*—Chairman, A. B. Gilbert, Saint John. The other Commissioners are W. S. Richards, Campbellton, N.B., and J. W. Wallace, Reynolds, N.B.

#### FOREST PROTECTIVE ASSOCIATIONS IN QUEBEC

##### THE SOUTHERN ST. LAWRENCE FOREST PROTECTIVE ASSOCIATION

*Head Office:* Quebec, P.Q. Organized, 1917. Number of Members, 39.

*Object.*—Forest-fire protection on the limits of the members. Area patrolled, 9,157 square miles.

*Officers.*—President, Julien E. Rothery; Sec.-Mgr., J. D. Brule, Val Brilliant, P.Q.

##### THE LAURENTIAN FOREST PROTECTIVE ASSOCIATION

*Head Office:* Quebec, P.Q. Organized, 1917. Number of Members, 28.

*Object.*—Forest-fire protection on the limits of the members. Area patrolled, 12,984 square miles.

*Officers.*—President, H. Sorgius; Secretary-Manager, P. W. MacKay.

##### THE OTTAWA RIVER FOREST PROTECTIVE ASSOCIATION

*Head Office:* Ottawa, Ontario (16 Fraser Bldg.). Organized, 1914. Number of Members, 36.

*Object.*—Forest-fire protection on the limits of the members. Area patrolled, 11,229 square miles.

*Officers.*—President, Fred. E. Bronson; Gen. Mgr., Arthur Graham; Secy., H. M. Small.



## THE ST. MAURICE FOREST PROTECTIVE ASSOCIATION

*Head Office:* Three Rivers, Quebec. Organized, 1912. Number of Members, 9.

*Object.*—Forest-fire protection on the limits of the members. Area patrolled, 15,000 square miles.

*Officers.*—President, Henry Sorgius; Manager, L. Judson; Secy., J. S. Duff.

## THE LOWER OTTAWA FOREST PROTECTIVE ASSOCIATION

*Head Office:* 189 Main St., Hull, Que. Organized, 1927. Number of Members, 4 Companies.

*Object.*—Forest-fire protection on the limits of the members. Area patrolled, 16,694 square miles.

*Officers.*—President, T. F. Kenny; Manager, N. C. Ferguson.

## THE PRICE BROTHERS FOREST PROTECTIVE ASSOCIATION

*Head Office:* Quebec, P.Q. Organized, 1924.

*Object.*—Forest-fire protection on the limits of the Association. Area patrolled, 11,267 square miles.

*Officers.*—President, John H. Price; Managers, R. D. Jago, E. H. Gunter, W. G. Wright. Secretary, K. A. Courser.

## ASSOCIATIONS OF MANUFACTURERS OF FOREST PRODUCTS

## CANADIAN PULP AND PAPER ASSOCIATION

*Head Office:* 3420 University street, Montreal, Quebec.

The Association was organized in 1913 with twenty-one charter members and now includes practically all the companies manufacturing wood-pulp or paper in Canada. It is divided into various sections representing the different branches of the industry. The Woodlands Section takes an active part in forestry in Canada.

The Association, through the Canadian Pulp and Paper Research Corporation, contributes largely to the support of the Pulp and Paper branch of the Forest Products Laboratories.

*Officers for 1935.*—President, Brig.-General J. B. White; Manager and Secretary, A. E. Cadman; Forester, A. M. Koroleff.

## CANADIAN LUMBERMEN'S ASSOCIATION

*Head Office:* Fraser Building, Ottawa. Organized August, 1908. Number of members, 158.

*Objects.*—To promote the interests and conserve the rights of those engaged in lumbering operations, or in the manufacture, sale, or distribution of lumber; protect its members against unbusinesslike methods in the wholesale and retail lumber trade; foster such trades, and reform abuses therein where they exist; secure freedom from unjust or unlawful exactions; diffuse accurate information among its members; and secure uniformity in usage, custom, and trade conditions.

*Officers.*—President, W. R. Beatty, Pembroke, Ontario; 1st Vice-Pres., N. F. Blair, Quebec City; 2nd Vice-Pres., K. S. MacLachlan, Edmundston, N.B.; Hon. Treas., R. G. Cameron, Ottawa; Secretary-Manager, R. L. Sargent, Fraser Building, Ottawa.

Two affiliated groups, the White Pine Bureau and the Hardwood Bureau, were organized in 1927 to promote their respective interests. The head office of the White Pine Bureau is at 200 Bay street, Toronto, Ontario; the Chairman is Jas. L. Crane, Thessalon, Ont., and the Manager, F. Albany Rowlett. The office of the Hardwood Bureau is in the Fraser Building, Ottawa; the Chairman is F. W. Hutcheson; and the Secretary, R. L. Sargent.

A Trade Promotion Committee was organized in 1934 with Hon. W. Gerard Power as Chairman and R. L. Sargent, Secretary, the main purpose of which is to promote the export trade of lumber from Eastern Canada. K. G. Fensom, Lumber Trade Commissioner for Eastern Canada, Sun Life Building, Trafalgar Square, London, represents the Committee in the United Kingdom.

## THE WESTERN RETAIL LUMBERMEN'S ASSOCIATION

*Head Office:* Scott Bldg., Winnipeg, Man.

*Object.*—To advance the interests of its members and give better service to the public through the advantages of co-operation.

Sec.-Treas., F. W. Ritter.

## THE WHOLESALE LUMBER DEALERS' ASSOCIATION OF ONTARIO

*Head Office:* Toronto, Ontario. Number of Members, about 20.

*Object.*—To promote and safeguard the business interests of its members.

*Officers.*—President, H. A. Leak; Secretary, Miss J. MacCallum.



## ONTARIO RETAIL LUMBER DEALERS' ASSOCIATION

*Head Office:* Toronto, Ontario. Organized, 1918.

*Object.*—To co-operate in all matters affecting the retail lumber trade so as to protect and further its interests.

*Officers.*—President, A. R. Stinson; Secretary, Horace Boulton.

## THE MONTREAL WHOLESALE LUMBER DEALERS' ASSOCIATION

*Head Office:* Montreal, Quebec. Organized, 1918. Number of members, 24 (companies or dealers).

*Object.*—To promote and protect in every way the interest of the wholesale lumber trade.

*Officers.*—President, T. C. leBoutillier; Secretary, G. C. Grimshaw.

## THE QUEBEC FOREST INDUSTRIES ASSOCIATION, LTD.

*Head Office:* Quebec, P.Q. (126 St. Peter street). Organized, 1924. Number of members, about 40.

*Object.*—To promote and facilitate the exchange of ideas in matters of forest protection, forest management, and forest utilization within the Province of Quebec; cordial and effective co-operation with the provincial government in every phase of forest conservation.

*Officers.*—President, Brig. Gen. J. B. White; Manager, J. A. Duchastel.

## NEW BRUNSWICK FOREST PRODUCTS ASSOCIATION

*Head Office:* Saint John, New Brunswick. Organized, 1928.

*Objects.*—

1. To develop the forest resources of the province.
2. To promote a cordial spirit of co-operation among the associated wood-using industries.
3. To promote forest conservation and the prevention of waste.
4. To furnish a central agency to widen the markets and increase the stability and prosperity of the timber industries of the Province.

Sec.-Treas., W. E. Anderson, Saint John, New Brunswick.

## NOVA SCOTIA FOREST PRODUCTS ASSOCIATION

*Head Office:* 62 Argyle street, Halifax. Organized, 1934.

*Objects.*—To secure uniform grading of lumber, improvement of manufacturing methods, and to develop wider markets and more orderly marketing through better co-operation.

*Officers.*—President, W. K. McKean; Secretary, W. McL. Robertson.

## BRITISH COLUMBIA LUMBER AND SHINGLE MANUFACTURERS' ASSOCIATION

*Head Office:* Metropolitan Building, Vancouver, B.C. Organized, 1900. Number of members, 50.

*Objects.*—This body, which is incorporated under the Companies Act, with a capital of \$50,000, and whose affairs are administered by a Board of Directors, has, among other objects the establishment of uniform rules for grading and measuring lumber products and, as far as possible, standardizing their manufacture, and such other measures as may be deemed for the general welfare of the members of the Association. The British Columbia Lumber Inspection Bureau is organized under this Association to ensure proper grading and certification of B.C. timber products, especially for the domestic and rail trade.

*Officers.*—President, J. D. McCormack; Secretary-Treasurer, T. H. Wilkinson.

## PACIFIC LUMBER INSPECTION BUREAU (INTERNATIONAL)

*Head Office:* Metropolitan Bldg., Vancouver, B.C. Organized, 1903. Number of members, 210 (47 in Canada—all in British Columbia).

*Object.*—The survey and inspection of timber products. This Bureau inspects and issues certificates for most of the lumber exported by vessel from the Pacific Coast.

*Officers.*—President, H. J. Mackin; Vice-President, R. W. Condon; Secretary-Manager, F. W. Alexander; Secretary, British Columbia Division, T. H. Wilkinson, Metropolitan Bldg., Vancouver.

## BRITISH COLUMBIA LOGGERS' ASSOCIATION

*Head office:* Metropolitan Bldg., Vancouver, B.C. Organized, 1907. Number of members, 60.

*Objects.*—(1) To bring together persons interested in the logging business for the promotion of co-operation within the industry and for the collection and interchange of information and



statistics regarding the production and consumption of logs; (2) to foster movements which would be beneficial to the general public interest and particularly to the logging industry; (3) to maintain stability by co-operative action in both production and values of the product dealt in by the members.

*Officers.*—President, F. S. Brown; Sec.-Mgr., R. V. Stuart.

#### ASSOCIATED TIMBER EXPORTERS OF BRITISH COLUMBIA, LTD.

Trade Mark ("Astexo"). *Head Office:* Vancouver, B.C.

Organized 1918. Member mills now thirty-six, controlling a large proportion of total export production of British Columbia.

*Objects.*—To provide lumber for export, stabilize prices, standardize specifications, and prevent shipping delays. Prices as a rule are quoted f.a.s.

*Officers.*—President, J. D. McCormack; Vice-Pres., J. A. Humbird; Manager, J. G. McConville.

#### SEABOARD LUMBER SALES, LIMITED

*Head Office:* Marine Building, Vancouver, B.C. Organized, 1935.

*Objects:*—To export lumber to the United Kingdom and other European markets. Prices quoted c.i.f.

*Officers.*—President, J. A. Humbird; Vice-Pres., Chris. McRae; Sec.-Manager, C. H. Grinnell.

#### RED CEDAR SHINGLE EXPORT ASSOCIATION

*Head Office.*—Vancouver, B.C. Organized, 1935.

*Objects.*—To handle export shingles to the U.S.A. and to facilitate quota shipments under the Marketing Act.

#### INTERIOR FOREST PRODUCTS ASSOCIATION

*Head Office.*—Calgary, Alta.

*Objects.*—To further the interests of its members and of the lumber industry in the interior of British Columbia.

*Officers.*—President, H. P. Klinestiver, Lumberton, B.C.; Secretary-Treasurer, I. R. Poole.

## 10—Education and Research

### EDUCATION

#### FACULTY OF FORESTRY, UNIVERSITY OF TORONTO

A Royal Commission on University of Toronto Affairs in 1906 recommended the establishment of a school for the training of foresters, and as a result the Faculty of Forestry at the University of Toronto was established in 1907. The late Dr. Bernhard E. Fernow, who had served from 1886 to 1898 as Chief Forester of the United States and who had established the first forest school in America at Cornell University where he was dean from 1898 to 1903, was invited to come to Canada as Dean of the Faculty, and for twelve years his aggressive but kindly influence was the guiding spirit of forestry in Canada. Upon his retirement in 1919, Clifton D. Howe, M.A., Ph.D., was appointed Dean. In addition there are four members of the Faculty, J. H. White, M.A., M.Sc.F., Ph.D.; T. W. Dwight, B.Sc.F., M.F.; R. C. Hosie B.Sc.F., M.A.; and G. G. Cozens, B.Sc.F., M.A.

The Faculty is provided with a well equipped building on the University campus and a camp in Algonquin Park for field-work.

The Faculty of Forestry of the University of Toronto offers a four-year undergraduate course, leading to the degree of Bachelor of Science in Forestry. The first two years are devoted mainly to subjects in the fundamental sciences, such as botany, chemistry, geology, mineralogy, physics, surveying, and the modern languages. The last two years are given over almost entirely to forestry subjects. The students are expected to engage in actual field-work during their summer vacations. In the academic year one-half of the student's time is taken up with field or laboratory work or in practice camp. The Faculty also offers a graduate course of two years leading to the Master's degree, and the Doctor's degree in the University may be obtained by the graduates of the Faculty.

There are now 203 living graduates from the Faculty of Forestry, 27 per cent of whom are employed in the Dominion or provincial forest services, 27 per cent in the pulp and paper industry, and 11 per cent in other forestry work.

#### THE FOREST SCHOOL OF THE UNIVERSITY OF NEW BRUNSWICK

The Forest School was added to the Provincial University at Fredericton in 1908, and since that time has occupied a prominent place in forestry education in Canada.



The course consists of four years leading to a degree of Bachelor of Science in Forestry, and a Master's degree may be secured five years subsequent to graduation upon furnishing satisfactory evidence of recognized progress in the field of forestry during these five years.

The first two years of the undergraduate course are devoted to preparatory courses in mathematics, basic sciences and modern languages with preliminary work in mensuration and forest botany and field-work in forestry. In the final two years the recognized subjects in general forestry are taught, in addition to surveying, highway engineering, forest engineering, hydraulics, and lumbering. A tract of 3,640 acres of forest land belonging to the university, within three miles of the college buildings, is administered by the Forest School and provides excellent facilities for demonstration and practice.

Greatly improved facilities in space and equipment were provided in 1930 through the construction and equipping of a large new building by the Provincial Government to house the Departments of Forestry and Geology.

J. Miles Gibson, B.Sc. F., is Professor of Forestry, and Byron W. Flieger, B.Sc. F., is professor of Forest Engineering.

Over 135 men have graduated from this school, most of whom have found employment with the various Canadian forest services and pulp and paper companies and in private practice.

#### SCHOOL OF SURVEYING AND FORESTRY, QUEBEC

A School of Forestry was founded by the Government of the Province of Quebec in 1910, primarily for the training of men for its own forest service. It has since been amalgamated with the School of Surveying, and is now known as L'École d'Arpentage et de Génie Forestier. It is affiliated with Laval University at Quebec. The course covers three years, leading to diplomas in both sciences. The diploma of surveyor is granted at the end of the second year, and that of forest engineer at the end of the third year. The instruction is given chiefly in the French language, although applicants for admission must be able to read and write English.

The fundamental studies include elementary and advanced mathematics, chemistry, physics, and mechanics. Special courses are provided in astronomy, meteorology, natural history, soils, surveying, medicine, public works construction, mineralogy, geology, law, botany and hydraulics. The forestry subjects include theory of forestry, planting, dendrology, utilization, silviculture, dendrometry, forest industries, wood-using industries, forest protection, forest technology, forest management, history of forestry, and forest economy and geography. In addition to lectures, experimental and practical work in field and laboratory is given in connection with most of the subjects.

Technical and practical work is provided every year in a forest located about twenty miles from Quebec, the property of Laval University, or in a township forest reserve, situated on the southern shore of the St. Lawrence. Instruction in nursery practice and planting is also given at the Berthierville nurseries. During the summer vacation, the students acquire experience in the forests on government or private work.

The Chief of the Forest Service, Quebec, is *ex officio* Inspector-General of Instruction in Forestry, and the Provincial Government grants \$15,000 annually to Laval University to aid in maintaining the school. Avila Bédard, M.A., M.F., is Director of the School.

#### FOREST RANGER SCHOOL, QUEBEC

Recognizing the necessity of training men for subordinate positions in forestry, the Quebec Government, in 1922, established a school for rangers. The school is located at Berthierville in connection with the nurseries.

The course covers eight months, divided into four terms of two months each, extended over a period of two years. Field practice under remunerative employment intervenes between the terms. This arrangement permits the students to be self-supporting throughout their course.

The object of the instruction is to fit men to act as forest rangers, fire rangers, fish and game wardens, cullers, foremen of forest operations, and so forth. A good common-school education is required for admission.

Elementary instruction is given in a number of subjects relating to forest protection and administration, but particular attention is paid to forest mensuration, surveying, and silviculture. The annual entry is limited to thirty students, and there are more applicants than can be accommodated. The school is supported by the Provincial Government under the Chief of the Forest Service, with Henri Roy, F.E., as Director.

#### PAPERMAKING SCHOOL, QUEBEC

The Papermaking School was established in 1923 in conjunction with the Technical School at Three Rivers. An advisory board selected by the Canadian Pulp and Paper Association co-operates in the direction of the school, and the Provincial Government makes an annual grant towards its support. The Chief of the Forest Service is Inspector General, as in the case of the other schools. In addition to the regular course, night courses are given. Victor Baillarge, F.E., is the Director.

#### THE UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, B.C.

The University of British Columbia at Vancouver has had since 1921 a department of forestry in which a four-year course is given leading to the degree of Bachelor of Applied Science in Forestry (B.A.Sc.).



The first two years of the course are largely engineering and fundamental sciences. The final two years are devoted mainly to forestry. Primarily the course is designed for the lumber industry and a major part of the time—apart from the preliminary foundation work—is devoted to branches of engineering and forestry most used by it. In addition, the fundamental forestry subjects are taught.

The location of the school at Vancouver offers exceptional advantages because extensive forests and logging operations, large sawmills, pulp-mills, and wood-using and wood-preserving plants are all within easy reach. A great asset is the University Forest, a one-hundred-acre belt located less than one-eighth of a mile from the campus. Not only does it add very much to the beauty of the surroundings, but it is valuable as a shelter-belt, a place of recreation, and a very convenient demonstration and field-study area for the departments of Forestry, Botany, and Zoology. A small forest nursery is maintained for experimental and demonstration work in silviculture and also to provide planting stock for the forest.

The Department of Forestry has the advantage of having the Dominion Forest Products Laboratory located at the University, and a co-operative arrangement prevails whereby the students have access to the laboratory to watch the investigations in progress and to use the equipment in studying the properties of Canadian woods.

F. Malcolm Knapp, M.S.F., is Acting Head of the Department and is assisted by one Instructor and four Honorary Lecturers.

There are thirty-six graduates from twelve classes graduating since the department was formed; 12 are employed in the Provincial or Dominion forest services, and 13 in forest industries.

## FOREST RESEARCH

### DOMINION FOREST SERVICE, DEPARTMENT OF THE INTERIOR

#### SILVICIAL RESEARCH

Silvical research was first definitely undertaken in Canada by the Commission of Conservation. In connection with a survey of the Trent watershed in Ontario in 1912 the effect of repeated fires on the reproduction of commercial species was studied. This was followed by investigations of regeneration on cut-over and burned-over lands in Quebec, Ontario, New Brunswick, and British Columbia. In addition to the single examinations of the existing conditions under which regeneration was taking place and the rate of growth of the various species, permanent sample plots were established on which the records of growth and mortality under natural and controlled conditions could be maintained.

#### *Forest Experiment Stations*

With the establishment of the Petawawa Forest Experiment Station in 1918, the Dominion Forest Service launched a plan of forest research as a definite part of its policy, and, when the Commission of Conservation was abolished in 1921, the Forest Service took over the research staff of the Commission and continued the projects that had been inaugurated by it.

The Petawawa Forest Experiment Station, which is a part of the Petawawa Military Reserve, is situated on the Ontario side of the Ottawa river, 125 miles northwest of the city of Ottawa. It includes 97 square miles and is typical of the mixedwood timber belt which extends from the Ottawa river to Georgian bay, south of lake Nipissing. The virgin stand, which was chiefly white and red pine, has been completely cut or burned within the past seventy-five years, but fortunately the area is for the most part well restocked with pine, pulpwood species, and hardwoods of several age-classes.

During recent years four additional research stations have been established, namely, the Valcartier, 7.25 square miles near Quebec city; the Acadian, 35 square miles near Fredericton, New Brunswick; the Duck Mountain, 36 square miles in Manitoba; and the Kananaskis, 62.6 square miles in the foot-hills of the Rocky mountains in Alberta. With the exception of Valcartier, which is a military reservation, these areas were transferred to the Dominion by the provinces in which they are situated. Negotiations are in progress for the establishment of another station in the coast district of British Columbia.

With the exception of the Kananaskis, these areas have all been photographed from the air, and intensive inventories have been or are being made with the view of placing them under scientific working plans which will serve as demonstrations of forest management as well as a locale for intensive silvicultural research.

Silvicultural investigations are not confined to the experimental areas, but are conducted on other lands in co-operation with the provincial forest authorities and private timber owners.

#### *Specific Research Projects*

Site classification based on the ground vegetation which reflects the differences in soil in relation to tree growth has been investigated in Manitoba and Alberta and at the Petawawa station with very encouraging results.

Phenological records concerning the seasonal life history of the most important plants are being taken on each of the forest experiment stations. Such data have an important bearing on problems of genetics.

Although advanced problems concerning forestry must be solved in the forest, many of the fundamental factors may be determined more readily in the nursery from which material for scientific studies in laboratory and field is provided, and a small nursery is maintained at each



station for this purpose. Nursery problems under way include the selection of seed and seedlings for improvement of strain, hybridizing of poplar and other species, and the improvement of soil conditions.

The development of poplar of rapid growth which is fungus-resistant and of fibre-quality suitable for match-stock is not the least of these nursery problems. There is a rapidly growing market for sound poplar for match stock and wood-pulp, and since perhaps no species responds more definitely to site conditions, the problem of producing poplar of high quality and quick growth is engaging the co-operative efforts of silviculturists, soil experts, and pathologists.

Conditions of soil, vegetation, and seed supply under which abandoned farm lands and burned areas become satisfactorily reforested, improvement of seed-bed conditions, and studies of the situations under which it may be necessary to resort to seeding or planting are problems under investigation.

Thinning experiments are being conducted to determine the best practical methods for each species and site to produce the maximum increment at a minimum cost. Such progress has been made on sample plots that dense young stands, especially of red, white and jack pine, are now being thinned on a large-scale basis with assurance that the results will be profitable.

In many mixedwood stands overmature yellow birch and maple with little value even for fuel-wood are suppressing conifers, and in stands from which the merchantable spruce and balsam fir have been utilized these hardwoods are preventing or retarding coniferous growth. The feasibility of removing this competition by girdling the hardwood is being studied on permanent sample plots.

The supply of clear white pine is rapidly disappearing, never to be replaced under present natural conditions. Determination of the economics of artificial pruning of young white pine is an important project under way at the Petawawa Forest Experiment Station.

The farmer's woodlot, though too often not appreciated by the owner, is ever growing in value, and by proper management can be made to provide profitable returns. The Forest Service has established a series of permanent sample plots in farmers' woodlots in Nova Scotia to demonstrate to the farmers the value of judicious thinning in increasing the yield and improving the quality of the product.

The maple sugar industry is very important to the farmers of Eastern Canada, and much progress has been made in the technique of collecting the sap, and preparing and marketing the product. No consideration has been given to date to improving forestry methods to increase the supply and quality of sap. The Forest Service is giving this some preliminary attention at the Valcartier Forest Experiment Station.

Various methods of cutting, including the selection system, cutting in groups, strip cutting, and clear cutting are being tried at the forest experiment stations. Similar experimental cutting areas have been established in co-operation with pulpwood operators. On each of these areas permanent sample plots are established to study the effect upon regeneration, maintenance of soil fertility, protection of the remaining stand, and the economic practicability of such methods.

Regeneration surveys to determine the conditions on cut-over pulpwood lands pertaining to reproduction as well as to growth and mortality have been carried on in Ontario, Quebec, and New Brunswick. On each area permanent sample plots were established to obtain detailed information and to check the general information provided by the survey data. Some of these areas established for ten or more years have been remeasured, and the results have been published.

#### *Reproduction and Rate-of-Growth Surveys*

At a conference of the Dominion and Provincial forest authorities held in Ottawa in 1929 a Canada-wide survey on a five-year plan was launched to make an inventory of timber resources, and to determine the increment which is accruing under natural conditions. To the Research Division of the Dominion Forest Service was assigned the task of investigating the growth-rate.

To determine the average annual increment based on the average growth for the past ten years for each species, age-class and subtype, four parties were placed in the field in 1929, one party in each of the provinces of Nova Scotia, New Brunswick, Quebec and Ontario. In 1930 eight parties were in the field, and sample areas were studied in Manitoba, Saskatchewan, Alberta, and British Columbia, as well as in the eastern provinces.

At the end of 1930 the work was temporarily suspended. However, the survey has been completed for the Province of New Brunswick, and for Nova Scotia, with the exception of Cape Breton island. It is expected that this investigation will be continued.

The data when compiled provide a statement of the wood content of the average acre by species and age-classes and the annual growth, the mortality, the amount and condition of reproduction, and a description of the soil, vegetation, and history of the stand.

In each forest belt areas were located for examination, and in each area ten or more blocks were selected as representative of the various types and age-classes as determined by ground or aerial surveys or by aerial reconnaissance. The blocks were usually about ten miles apart. In each block one hundred mechanically selected sample plots, one chain square, were established at ten-chain intervals. No consideration is given to abnormal mortality due to fire, insects, or fungous diseases, other than was encountered on the sample plots examined.

Though these surveys have for the most part been conducted in the forest belts in which the conditions for forest growth are more favourable, and though the area covered is still far from sufficient for a general estimate of the increment in the Dominion, the results to date are interesting in that they indicate that the increment in these localities at least is larger than was anticipated, and compares favourably with that of European forests.



To date, 17,120 sample plots have been carefully studied, and, in addition, the increment has been measured on 18,000 trees. A summary of the results of these surveys is shown in the following table:—

AVERAGE STAND, INCREMENT, AND MORTALITY AS SHOWN BY RATE-OF-GROWTH SURVEYS

—	Represent- ation of type	Under 60 years of age	Total Volume per acre	Net Annual Increment	Average Annual Mortality
	Per cent	Per cent	Cu. Ft.	Cu. Ft.	Cu. Ft.
NOVA SCOTIA: Mainland (3,000 sample plots)					
Softwood.....	45	28	1,546	48	11.4
Mixedwood.....	25	14	1,813	44	13.8
Hardwood.....	30	21	878	25	5.6
All types.....	100	63	1,412	40	10.2
NEW BRUNSWICK (3,636 sample plots)					
Softwood.....	36	25	1,319	45	3.8
Swamp.....	18	8	1,170	29	5.6
Mixedwood.....	27	13	1,256	40	4.2
Hardwood.....	19	13	1,131	33	5.9
All types.....	100	59	1,239	37	4.6
QUEBEC: Gatineau and Lièvre watersheds (2,693 sample plots)					
Softwood.....	22	7	1,600	41	7.5
Swamp.....	7	.....	1,439	28	4.8
Mixedwood.....	43	3	2,096	49	5.1
Hardwood.....	28	13	1,598	43	3.3
All types.....	100	23	1,798	44	5.1
ONTARIO: Algonquin Park (1,600 sample plots)					
Softwood.....	8	7	1,282	51}	8.3
Swamp.....	1	.....	1,430	22}	
Mixedwood.....	47	33	1,842	52	4.8
Hardwood.....	44	19	1,744	35	2.8
All types.....	100	59	1,750	44	4.2
ONTARIO: Sudbury Region (2,000 sample plots)					
Softwood.....	28	17	2,105	36	16.8
Swamp.....	9	.....	1,327	11	23.4
Mixedwood.....	44	22	2,085	49	8.7
Hardwood.....	19	12	1,372	47	3.7
All types.....	100	51	2,030	46	11.8
MANITOBA-SASKATCHEWAN: Cretaceous escarpment (1,435 sample plots)					
Softwood.....	9	10	1,645	25	31.4
Swamp.....	8	.....	1,073	5	20.5
Mixedwood.....	25	14	2,843	32	32.0
Hardwood.....	55	36	1,890	43	22.9
All types.....	100	60	1,969	35	26.0
ALBERTA: Southeastern foot-hills (1,700 sample plots)					
Softwood.....	77	54	1,665	47	9.6
Swamp.....	9	.....	501	3	13.1
Mixedwood.....	6	6	1,284	39	4.3
Hardwood.....	8	7	1,093	41	3.2
All types.....	100	67	1,492	42	9.1
BRITISH COLUMBIA: Coast (1,056 sample plots)					
Cedar-Hemlock.....	.....	.....	6,684	71	20.2



## FOREST-FIRE HAZARD RESEARCH

In view of the forest and climatic conditions obtaining in Canada, the problem of reducing forest-fire losses is one of paramount importance. The Dominion Forest Service has for some time recognized the need of a unit for measuring cumulative fire-hazard or inflammability that will enable forest authorities to know what to expect each day and so be in a position to make their plans accordingly. Obviously, there are many undertakings the forest officer can plan better and more economically if he knows the degree of fire-hazard which exists each day in his territory.

In 1926 the Forest Service began a study of the effect of weather factors upon the occurrence of forest fires, and since 1929 intensive research work in forest-fire hazard has been carried on at the Petawawa Forest Experiment Station.

It has been found that the percentage of moisture content of the forest materials in which fires start and spread affords the best measure of forest inflammability. As a result of many tests, zones of inflammability, styled Nil, Low, Moderate, High, and Extreme, have been established covering various fuel moisture contents in the forest types studied. The moisture content of these materials, or fuels, depends almost entirely upon the weather. By observing the relationship which exists between the moisture content of the materials and the various weather factors, it has been found possible to develop tables for computing an index or measure of forest inflammability. It is now possible by the aid of these tables and a daily record of rainfall, rate of evaporation, and relative humidity of the air, to compute each day the index of inflammability which exists in any type of forest for which the necessary data have been collected. This index of inflammability can be shown in graphical form, and is termed a fire-hazard chart.

Some of the ways in which a knowledge of the daily degree of fire-hazard revealed by a fire-hazard chart may be used are: to detail the work of forest employees engaged on construction or improvements so that they will be immediately available for fire duty if the inflammability warrants; to determine the number of men necessary to send to a fire; to regulate the issuance or cancellation of permits to burn slash or forest debris, issued to settlers and others, so that such burning may be conducted in safe periods; to control travel in, and use of, the forest by the public; to regulate the frequency of forest patrols, and to know when it is safe to allow lookout-tower men off duty. In the past, decisions on most of the above points have had to depend on the judgment of the individual forest officer, and many fires and much needless expense have occurred owing to faulty estimates of the degree of hazard existing at the time.

The method devised for computing the daily degree of fire-hazard has now been in practical field use in a number of localities in Eastern Canada for several years, and instances are on record where its use has resulted in a reduction of fire-fighting costs and timber loss. This system has been submitted to rigid tests over a five-year period and shows an accuracy of from 96 to 99 per cent in indicating the probability of occurrence and the behaviour of forest fires.

A further improvement in technique has been achieved in recent months through the development of a slide-rule which embodies the data contained in the fire-hazard tables. By means of this slide-rule the daily hazard may be obtained in a few moments.

Forest-fire hazard research is a new branch of science, and, as there are no precedents to follow, the practical results enumerated above have been arrived at only after much experimentation. Special apparatus has had to be designed to meet new requirements, and the entire technique now in use had to be evolved as the study progressed.

There is a great need for improvement in the accuracy of weather forecasts. An accurate forecast used in conjunction with the fire-hazard charts will enable the degree of hazard to be computed some days ahead; the advantage of this is apparent. Research work towards this end is being carried on in co-operation with the Meteorological Service of Canada.

The forest-fire hazard research work of the Forest Service has been confined largely to the pine regions of eastern Ontario and western Quebec. The results are so promising that it is expected that ultimately this investigative work will be extended to cover all climatic and forest types in Canada.

## AERIAL PHOTOGRAPHIC RESEARCH

Since 1927, the Dominion Forest Service has carried on research in the application of aerial photography to forestry. This includes the identification of species and types, the development of methods of measuring tree heights in both vertical and oblique photographs, and of estimating the volume of timber in the stands and also the development of methods of conducting aerial surveys and of the equipment required.

## BRITISH COLUMBIA

The first attempts at studying the problems of the forests of British Columbia took the form of spasmodic investigations by the various forest districts, but pressure of routine duties and lack of directions mitigated against the accomplishment of tangible results. In 1920 a qualified forester was appointed to carry on silvical investigations and the program gradually expanded until in 1927 the organization of a small research division became warranted.



*Experimental Stations*

Two permanent research stations are now maintained: namely, the Aleza Lake Experiment Station, established in 1924 in the spruce-balsam type of the North-central Interior, and the Cowichan Lake Experiment Station established in 1929 in the Douglas fir type of the Coast, at which silvicultural investigations relative to these two types are concentrated as far as possible. Studies requiring a more extensive field are conducted on small sample-plot reserve areas distributed throughout the different forest types of the province.

The Green Timbers Forest Nursery was established in 1929 near New Westminster to supply planting stock for logged- and burned-over areas of the Coast district not satisfactorily restocking. Besides the three permanent stations mentioned, four other areas are under reserve for purposes of experiment and demonstration.

A description of the stations and their work and of investigations covering more extensive fields are briefly outlined below.

*Aleza Lake Experiment Station.*—This station consists of an area of 6,600 acres, of which 400 acres have been logged. The remainder is covered with a mature stand of spruce and balsam. It was established for the purpose of determining and demonstrating efficient methods of maintaining the forests of this type on a productive basis. A tentative management plan has been drawn up, involving an annual cut of  $1\frac{1}{2}$  million feet board measure, but it was necessary to suspend logging operations in 1929 when it became impossible to dispose of the logs.

The investigative program includes studies relative to the establishment of reproduction under the mature stand of timber and on logged- and burned-over areas, the factors influencing the production of seed, and the effect of different methods of logging and brush disposal on the subsequent establishment of reproduction. Permanent plots have been established in residual stands remaining after logging to determine their development and rate of growth.

*Cowichan Lake Experiment Station.*—This station, comprising an area of 500 acres, is covered with an excellent stand of Douglas fir second growth of an average age of about 30 years. Investigations have been inaugurated relative to the effects of thinning and pruning young stands of Douglas fir; the extent of damages resulting from the Shoe-string Rot (*Armillaria mellea*), the factors influencing the production of seed; the rate of growth of Douglas fir second growth, and other miscellaneous projects. Studies having to do with the natural and artificial establishment of reproduction are carried on from the station on extensive areas of logged- and burned-over lands in the near vicinity.

*Forest Nursery.*—The Green Timbers Station consists of 620 acres of land, 20 acres of which have been selected as a forest nursery site. The remaining 600 acres have been reserved for experimental plantations, of which 259 acres have already been planted. The nursery has been consistently developed until it is now in a position to produce 1,000,000 transplants per year. Incidental to its main purpose of producing planting stock, studies are conducted as a guide to improved methods of nursery practice.

*Regeneration Studies*

Nine extensive areas of logged- and burned-over land of the Coast forest types, involving 3,028 separate plots, are examined at regular intervals to determine the rate at which natural restocking takes place and to what extent natural restocking may be relied upon in re-establishing the forest cover over extensive logged-over areas.

*Mensuration Studies*

Volume tables have been compiled for practically all the merchantable species of the province. Yield tables have been compiled from temporary-plot data for species ordinarily growing in pure even-aged stands, including Douglas fir, Western hemlock, lodgepole pine, and Engelmann spruce. Throughout the province 115 permanent plots have been established in the different types for various purposes relative to growth and yield, and these are re-examined at regular intervals.

*Plantations*

Most of the planting to date has been on a purely experimental basis on small reserved areas. Transplants to the number of 734,000 have been planted on areas totalling 1,006 acres. Periodic examinations are made of the plantations and records of their development maintained. From the standpoint of nursery capacity and also that of experience, the Division is now in a position to undertake a larger program than has been attempted to date whenever this may prove desirable.

## PRAIRIE PROVINCES

In the Provinces of Alberta, Saskatchewan, and Manitoba forest research is for the most part carried on in co-operation with the Dominion Forest Service, though planting experiments and some silvicultural experiments are conducted by each provincial service in the forest reserves.

## ONTARIO

At the Forest Nursery Station at St. Williams, the Forestry Branch is conducting a number of interesting experiments in natural and artificial regeneration. The fixation of shifting sand



by various methods has been tried at several places. Intensive studies of reproduction and rate of growth, especially of white pine, have been conducted for several years for the purpose of developing yield tables. A successful series of experiments in the flotation of hardwood has been carried on.

#### QUEBEC

Experiments in artificial regeneration are in progress at the Berthierville nursery station and elsewhere throughout the province.

#### MARITIME PROVINCES

In New Brunswick and Nova Scotia silvicultural research is being carried on in co-operation with the Dominion Forest Service.

#### FOREST RESEARCH CO-OPERATIVE COMMITTEE

The Canadian Society of Forest Engineers has appointed a committee the objects of which are:—

- (1) To provide a means of informing all those interested as to the research work that has been, or is being, conducted;
- (2) To provide those conducting research projects with information as to the problems which require study;
- (3) To secure the co-operation of research officers and the forest industries in carrying out research and in the practical application of the findings in forest management;
- (4) To determine the best means of conducting the various research projects;
- (5) To co-ordinate the various branches of research which are in a large measure interdependent, such as entomological, pathological, and silvicultural problems;
- (6) To secure the united support of all forest interests for forest research;
- (7) To establish personal contacts between the men engaged in forest research and those in whose interests they are working.

Most of the work will be carried on by sub-committees which will report to the main committee. Sub-committees have been appointed for the following divisions: silviculture, entomology, pathology, surveys, utilization, reforestation, farm woodlots, and education.

## 11—Annual Increment and Utilization

### INCREMENT

There are as yet insufficient data upon which to venture an estimate of the total forest increment. In 1929 and 1930 the Forest Service conducted a number of rate-of-growth surveys in various parts of the Dominion, but, with the exception of New Brunswick, the area covered in any one province was too limited to be representative. (See Section 10.) The average annual increment of from 35 to 71 cubic feet per acre indicated by these surveys applies only to young stands in the more favourably situated forests, and does not allow for depletion due to fire, or for wide-spread destruction by insects, fungous diseases, or windfall. A considerable proportion of the increment—perhaps one-half—occurs on the trees of the less desirable species, such as poplar and white birch, which comprise a large percentage of the reproduction after fire. However, these surveys, when completed and applied to the various types, will give definite information as to the increment which accrues.

Of the accessible forest area—512,500,000 acres—it is estimated that there are perhaps 112,500,000 acres of mature timber in which growth is offset by decay, and that any net increment which is taking place is on about 400,000,000 acres of young growth or the younger stands of merchantable timber. An average annual increment of ten cubic feet per annum on this area would yield 4,000 million cubic feet, and as the virgin stands are cut the growing area is increased. Since the average in Europe is about 25 cubic feet, it would appear to be quite within the productive capacity of Canadian forests to yield 10,000 million cubic feet per annum.

TABLE III.—It is impossible to fill out this table from the data available.

### DEPLETION

The utilization of the forest resources has been so greatly curtailed during the last four years, owing to economic conditions, that it cannot be used as a basis for estimating the normal demands that may be made on the forests in the future. The years 1926 to 1930 were typical of recent normal production, and the indications are that the demand for forest products will soon be back to that basis. In those five years the average annual utilization amounted to 2,970 million cubic feet of standing timber.

To this must be added the depletion due to fire, which during the past ten years—1925-1934—has averaged 226 million cubic feet of merchantable timber, and the accumulated increment of perhaps thirty years on 873,327 acres of young growth and cut-over lands. Allowing for an annual increment of ten cubic feet per acre, the destruction of this young growth may very conservatively be considered the potential equivalent of 262 million cubic feet.



The current annual loss due to insects and decay, though difficult to estimate, is placed at 700 million cubic feet.

The total annual depletion under normal conditions of production may therefore be estimated to be about 4,158 million cubic feet.

Until the growth studies are completed and the distribution of age-classes is known, it will be impossible to tell whether the forest resources as a whole are being depleted or not. Certainly, in some districts they have already been seriously depleted, and this depletion has necessitated either the moving of the industries dependent on them or the transportation of the timber from more distant sources. The exhaustion of local supplies of timber has forced the abandonment of many sawmills and the consequent impoverishment of the settlements which had grown up around them. With a knowledge of the productive capacity of the forests and the adoption of suitable working plans, these industries could have been operated on a permanent basis.

TABLE IV.—AVERAGE ANNUAL UTILIZATION OF HOME-GROWN TIMBER  
CALENDAR YEARS 1929-1933  
Equivalent in Standing Timber

	Conifers		Broad-leaved		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
	Million Cubic feet	\$	Million Cubic feet	\$	Million Cubic feet	\$
Total.....	1,686	136,444,013	769	37,989,306	2,455	174,433,319

NOTE.—Records of the cut on State and private lands are not separated, but it is estimated that about 75 per cent of the softwood and 10 per cent of the hardwood is cut on State lands. About 88 per cent of the hardwood used is fuel-wood, most of which is cut on farmers' woodlots.

The statistics collected in a number of important items do not separate conifers and broad-leaved species, and the amounts and values of each are estimated.

12—Forest Industries

The production of the forest industries in Canada has been considerably reduced, both in volume and value, during the past four years, 1931-34, owing to the economic situation prevalent throughout the world.

The industries requiring wood as the principal raw material represent, in number of plants, capital invested, number of employees, wages paid, and value of products, about one-quarter of the total of the manufacturing industries in Canada. During 1926-30 the capital invested in forest industries amounted, on the average, to \$1,280,400,000; the number of employees, 244,000; wages paid, \$249,599,000; and the value of the products, \$582,570,000.

In 1933, the last year for which statistics are available, the situation was as follows:

	Capital invested	Number of employees	Salaries and wages	Value added by manufacture
	\$		\$	\$
Woods operations.....	112,000,000	65,000	46,800,000	93,773,000
Lumber industry.....	80,796,425	18,285	10,761,090	15,101,071
Wood-using industries.....	98,974,861	23,284	17,072,422	28,618,483
Pulp and paper industry.....	559,265,544	24,037	26,591,049	75,782,971
Paper-using industries.....	160,582,610	41,280	48,779,202	86,186,357
Total.....	1,011,619,440	171,886	150,003,763	299,461,882

WOODS OPERATIONS

Woods operations during 1926-30 represented a capital investment of \$183,000,000, provided employment on an average annual basis to 91,000 men, to whom \$74,600,000 was paid in salaries and wages, and the value of the products (logs, pulpwood, etc.) averaged \$210,000,000.

Though logging operations are conducted throughout the year in the coastal belt of British Columbia, in the rest of the Dominion they are for the most part confined to the winter months. The camps usually open in October so that the cutting can be completed before the snow gets too deep, and then the logs are hauled out to the streams or railways on sleighs. During 1926 to 1930 the number on the monthly pay-rolls varied from about 54,500 in August to 139,000 in February, averaging 63,000 for the six months April to September, 119,000 for October to March, and 91,000 for the year. The employment of from 50,000 to 75,000 additional men during the winter is of the greatest importance, for during that season in many occupations such as agriculture, construction, and navigation there is either a partial or a complete cessation of work, and the lumber camps not only absorb much of the floating labour but provide work for many thousands of farmers and their horses, especially in the newer settlements where such additional source of revenue is most needed.



The index of employment in the woods based on the year 1926 as 100 has been as follows:—

1926.....	100	1929.....	125·8	1932.....	42·5
1927.....	109·3	1930.....	108·0	1933.....	66·5
1928.....	114·5	1931.....	60·1	1934.....	124·7

LUMBER

From 1908 to 1930 the production of lumber averaged about 4,000 million feet board measure. In 1932 it dropped to 1,810 million feet, the lowest on record, but during the subsequent two years steady progress towards recovery has been made, owing to the increased overseas trade, especially with the United Kingdom.

During 1926-30, the lumber industry included 3,531 reporting mills, in which \$181,117,000 was invested; 43,457 employees received \$28,513,000 in wages, and the value of the products was approximately \$119,700,000, of which \$56,570,000 was value added by manufacture.

TABLE V.—TIMBER USED BY PRIMARY FOREST INDUSTRIES, AND VALUE OF PRODUCTS  
Average Calendar Years 1929-1933

Industry	Quantity of Timber consumed (home-grown and imported)		Value of Products	Number of Employees(a)
	Expressed in commercial units	Equivalent in standing timber		
<i>Lumber Industry—</i>		1,000 cu. ft.	\$	
Lumber, M ft. board measure.....	2,999,358	656,859	60,325,904	
Lath, M pcs.....	364,415	9,985	1,079,745	
Shingles, M pcs.....	1,963,375	43,194	5,229,826	
Logs imported, M ft. board measure.....	17,844	3,908	299,254	
Total.....		713,946	(c) 66,934,729	29,670
<i>Pulp and Paper Industry—</i>				
Paper manufactured, tons.....	2,689,070	383,600	144,343,780	
Pulp exported, tons.....	654,882	122,000	30,953,861	
Pulp imported, tons.....	14,389	2,682		
Pulpwood imported, cords.....	50,742	5,937		
Total.....		514,219	175,297,641	28,400
<i>Woods Products—</i>				
Pulpwood exported, cords.....	984,289	115,162	9,162,582	
Square timber exported, M ft. board measure.....	71,174	15,587	1,475,068	
Logs exported, M ft. board measure.....	256,458	56,164	2,896,241	
Hewn railway ties, Pcs.....	5,487,808	65,854	3,527,581	
Poles, Pcs.....	753,302	9,793	3,768,705	
Posts, Pcs.....	15,084,757	30,170	1,321,681	
Fence-rails, pcs.....	5,208,122	15,624	405,068	
Mining timber, cu. ft.....	4,979,692	6,474	904,766	
Fuel-wood, cords.....	9,429,805	895,831	38,311,451	
Wood for Distillation, cords.....	41,559	5,112	330,151	
Miscellaneous, cords.....	196,256	22,962	1,739,572	
Total.....		1,238,733	63,842,866	(b) 67,000
GRAND TOTAL.....		2,466,898	306,075,236	125,070

(a) Figured on a yearly basis.  
(b) Includes all woods operations.  
(c) Does not include a number of minor sawmill products.

TABLE VA.—PRODUCTION OF LUMBER, LATH, AND SHINGLES  
Calendar Years 1908 to 1933

Year	Lumber			Lath			Shingles		
	Quantity, M ft. B.M.	Value	Average price per M B.F.	Quantity, M pieces	Value	Average price per M pieces	Quantity, M pieces	Value	Average price per M pieces
Average		\$	\$ cts.		\$	\$ cts.		\$	\$ cts.
1908-1912.....	4,184,329	66,574,697	15 95	823,838	1,883,956	2 28	1,721,752	3,352,471	1 95
1913-1917.....	3,849,565	66,020,012	17 10	726,347	1,797,117	2 61	2,467,364	5,376,477	2 15
1918-1922.....	3,603,382	112,220,493	30 61	711,241	3,730,940	4 98	2,785,414	11,506,282	4 12
1923-1927.....	3,955,906	102,202,146	25 91	1,262,710	6,169,277	4 90	3,028,218	10,083,198	3 33
1928.....	4,337,253	103,590,035	23 88	1,138,417	4,802,616	4 22	2,865,994	10,321,341	3 60
1929.....	4,741,941	113,349,886	23 90	835,799	2,860,799	3 42	2,707,235	9,423,363	3 48
1930.....	3,989,421	87,710,957	21 98	398,254	1,154,593	2 90	1,914,836	5,388,837	2 81
1931.....	2,497,553	45,977,843	18 41	228,050	576,080	2 53	1,453,277	3,331,229	2 29
1932.....	1,809,884	26,881,924	14 85	208,321	474,889	2 28	1,802,008	3,556,823	1 97
1933.....	1,957,989	27,708,908	14 15	151,653	332,364	2 19	1,939,519	4,448,876	2 29



TABLE VB.—AVERAGE ANNUAL LUMBER PRODUCTION, BY SPECIES  
Calendar Years 1929-1933

Species	Quantity	Value
	M ft. B.M.	\$
<i>Conifers—</i>		
Douglas Fir.....	1,051,262	17,258,924
Spruce.....	852,924	17,270,664
White Pine.....	306,794	8,907,232
Hemlock.....	251,730	4,060,710
Cedar.....	100,784	2,398,675
Balsam Fir.....	76,115	1,277,264
Jack and Lodgepole Pine.....	72,345	1,446,435
Red Pine.....	55,409	1,505,798
Ponderosa Pine.....	23,656	446,759
Tamarack, or Larch.....	13,459	247,855
Yellow Cedar.....	455	22,054
Total Conifers.....	2,804,933	54,842,370
<i>Broad-leaved—</i>		
Birch, Yellow.....	81,863	2,313,654
Maple.....	37,974	1,209,201
Basswood.....	16,380	482,189
Poplar.....	14,201	220,386
Birch, White.....	13,592	362,787
Elm.....	12,856	398,946
Beech.....	6,283	155,068
Ash.....	4,718	143,567
Oak.....	2,441	92,517
Chestnut.....	499	14,573
Cherry.....	143	4,524
Red Alder.....	135	2,032
Butternut.....	119	3,474
Hickory.....	69	2,460
Walnut.....	52	2,221
Tulip.....	7	221
Sycamore.....	1	20
Unspecified.....	3,094	75,695
Total Broad-leaved.....	194,427	5,483,535
GRAND TOTAL.....	2,999,360	60,325,905

TABLE VC.—AVERAGE ANNUAL PRODUCTION OF LUMBER, LATH, AND SHINGLES, BY PROVINCES  
Calendar Years 1929-1933

Provinces	Lumber		Lath		Shingles	
	M ft. B.M.	Value	M pieces	Value	M pieces	Value
		\$		\$		\$
Prince Edward Island.....	4,856	103,147	241	902	4,998	12,948
Nova Scotia.....	107,837	1,819,593	15,084	42,496	23,053	59,397
New Brunswick.....	196,407	4,255,853	84,614	232,533	101,964	282,480
Quebec.....	468,571	10,496,740	108,941	298,062	219,916	555,730
Ontario.....	497,711	13,922,252	77,313	259,508	12,880	47,665
Total Eastern.....	1,275,382	30,597,585	286,193	833,501	362,811	958,220
Manitoba.....	49,664	983,202	5,881	24,104	311	819
Saskatchewan.....	26,841	528,427	841	3,184	189	440
Alberta.....	87,676	1,474,778	7,660	25,306	173	428
Total Prairies.....	164,181	2,986,407	14,382	52,594	673	1,687
British Columbia.....	1,559,796	26,741,911	63,840	193,649	1,599,892	4,269,919
TOTAL: CANADA.....	2,999,359	60,325,903	364,415	1,079,744	1,963,376	5,229,826

## PULP AND PAPER

The pulp and paper industry is the most important manufacturing industry in Canada. During 1926-30 it had 109 plants, with invested capital of \$625,187,000, employed 33,000 people, to whom \$46,632,000 was paid, and the value of the products averaged \$221,013,000, which included \$138,000,000 added to the value of the raw material used.

The pulp and paper industry has experienced the most critical period in its history during the last four years. The production in 1932 was reduced in volume about 20 per cent as compared with the average of 1926-30, and though during the two succeeding years the amount manufactured has increased until in 1934 the pre-depression status has been almost regained, the prices have been so low that the value is still considerably below that of previous years.



TABLE VD.—PRODUCTION OF PULP AND PAPER

	Newsprint		Total paper	Wood-pulp		Total pulp and paper
	Quantity	Value	Value	Quantity	Value	Value
	Tons	\$	\$	Tons	\$	\$
Average 1926-30.....	2,314,671	136,341,249	175,600,877	3,551,478	118,433,998	294,034,875
1931.....	2,221,551	111,050,704	143,957,264	3,167,960	84,780,819	222,738,083
1932.....	1,915,479	85,304,536	114,115,570	2,663,248	64,412,453	178,528,023
1933.....	2,016,612	66,714,677	97,030,429	2,979,562	64,114,074	161,144,503
1934.....	2,597,641*					

\* From Newsprint Service Bureau.

TABLE VE.—PRODUCTION OF PULPWOOD  
Calendar years, 1908 to 1933

	Total production			Exported			Consumed in Canada	
	Quantity	Value	Average value per cord	Quantity	Value	Per cent of total	Quantity	Value
	cords	\$	\$	cords	\$		cords	\$
Average { 1908-1912.....	1,558,321	9,686,778	6 20	909,876	5,779,885	58.4	648,345	3,906,893
1913-1917.....	2,530,359	18,277,132	7.23	1,008,661	6,940,853	39.9	1,521,698	11,336,279
1918-1922.....	3,656,232	48,929,360	13.38	1,154,220	12,869,782	31.6	2,502,012	36,059,622
1923-1927.....	5,189,012	63,092,794	12.60	1,414,298	14,199,946	27.3	3,774,719	48,892,848
1928.....	6,295,912	74,587,843	11.85	1,532,266	15,269,660	24.3	4,763,646	59,318,173
1929.....	6,536,335	76,120,063	11.65	1,294,995	13,314,738	19.8	5,241,340	62,805,325
1930.....	5,977,183	67,529,612	11.29	1,330,466	13,611,617	22.2	4,646,717	53,917,995
1931.....	5,046,291	51,973,243	10.30	957,303	9,359,592	19.0	4,088,988	42,613,651
1932.....	4,188,732	36,750,910	8.77	583,454	4,830,506	13.9	3,605,278	31,920,404
1933.....	4,746,383	33,213,973	7.00	718,556	4,696,459	15.1	4,027,827	28,517,514

TABLE VF.—PRODUCTION OF PULPWOOD BY PROVINCES  
AVERAGE FOR CALENDAR YEARS, 1929-1933

Province	Quantity	Value
	Cords	\$
Quebec.....	2,968,261	30,588,902
Ontario.....	1,338,836	13,608,775
British Columbia.....	371,979	2,893,625
Other provinces (a).....	619,908	6,026,259
Total Canada.....	5,298,984	53,117,561

(a) Pulpwood production in Nova Scotia, New Brunswick, Manitoba, and Saskatchewan not accounted for individually. No production in Prince Edward Island or Alberta.

SECONDARY INDUSTRIES

In the 2,100 secondary wood-using industries \$136,458,000 was invested, 35,000 people were employed, and \$37,150,000 was paid in wages. The gross value of the products was \$136,500,000, and the value added by manufacture \$66,000,000.

The secondary paper-using industries had \$158,759,000 invested capital and 42,000 employees who received \$57,417,000; and the gross value of the products was about \$188,000,000, of which \$126,000,000 was added through manufacture.

TRANSPORTATION OF FOREST PRODUCTS

The number of railway cars used in the transportation of forest products is a good index of the trade in these products, even though considerable amounts of lumber, pulp and paper, and other wood products are loaded directly on vessels for overseas shipment.

The reduction in the revenue of Canadian railways during the past four years to a considerable extent is due to the decreased movement in forest products. The average number of cars used for this purpose annually during 1926 to 1930 was 595,528. In 1932 the number was reduced to 252,162, but during the two succeeding years the number used for each of the four classifications of forest products has been substantially increased. The increasing proportion used for these products indicates a relatively greater degree of recovery in the forest industries than in other industries as a whole.

NUMBER OF CARS LOADED WITH FOREST PRODUCTS ON CANADIAN RAILWAYS

Calendar year	Lumber	Pulp and paper	Pulpwood	Other forest products	Total forest products	Per cent of total cars
1926-30 average.....	178,278	121,546	140,021	155,682	585,528	17.5
1931.....	94,235	94,571	73,633	89,757	352,196	13.7
1932.....	58,531	71,746	43,560	78,325	252,162	11.6
1933.....	65,693	78,786	48,079	82,657	275,215	13.5
1934.....	81,652	96,944	63,821	100,025	342,442	14.8



MINOR FOREST PRODUCTS

The wood-distillation industry in Canada is confined to the use of hardwoods; beech, birch, and maple are the species commonly used. The most important products of this industry are charcoal, grey acetate of lime, methyl hydrate (wood alcohol), columbian spirits, acetic acid, formaldehyde, and acetone. The value of these products in 1932 amounted to \$677,989, of which \$326,082 was attributable to charcoal. This is a considerable decrease from the pre-depression period, when the value of these products was close to \$2,000,000. This industry reached its peak in production during the years of the Great War, when large quantities of acetic acid and acetone were exported.

Canada balsam, an oleoresinous exudation from the balsam fir tree, is an important adhesive used principally for the cementing of lenses, because of its transparency. It has medicinal value also, and has been used for years in various pharmaceutical compounds. Spruce gum, extracted from the spruces of Eastern Canada, is also used in many medicinal preparations, as well as in certain kinds of chewing gum. No statistics are available as to the production values of these products, but in the case of Canada balsam the value of exports amounts to \$15,000 to \$20,000 annually.

Eastern hemlock bark is used in considerable quantities as a source of tannin for the leather industry, over 10,000 cords, valued at approximately \$120,000, being used annually. Western hemlock bark has about the same tannin content (7 to 12 per cent), but is not used in any great quantity.

FACTORS USED FOR CONVERTING VARIOUS UNITS OF MEASUREMENT OF WOOD TO CUBIC FEET

Product	Unit in use in Canada	Volume	Equivalent
		used	in standing timber
		Cubic feet	Cubic feet
Sawn lumber.....	1,000 ft. B.M.	83.33	219
Logs.....	1,000 "	83.33	219
Shingles.....	1,000 pieces	8.33	22
Lath.....	1,000 "	13.83	36.3
Pulpwood.....	1 cord	90.00	117
Fuel-wood.....	1 "	90.00	95
Distillation wood.....	1 "	90.00	123
Railway ties (hewed).....	1 piece.	3.00	12
Poles.....	1 "	10.00	13
Piling.....	1 "	10.00	13
Fence-posts.....	1 "	1.50	2

13—Exports and Imports of Forest Products

A.—EXPORTS

Canada's exports of forest products usually represent about 43 per cent of the volume of timber cut and about 57 per cent of the value of such products, and therefore the forest industries are dependent to a very large extent on world markets for the disposal of their products.

Forest products rank next to agricultural products in the export trade of the Dominion, and always provide a substantial balance of trade which, during 1926-1930, amounted to over \$240,000,000 annually. Though materially reduced during the four succeeding years in both volume and value, the external trade in forest products has been of relatively greater importance in maintaining Canada's international credit. During 1931-34 forest products comprised 26.65 per cent of the total exports, as compared with 23.6 per cent during 1926-30, and the imports of forest products were only 2.84 per cent of the total in the last four years, as compared with 3.3 per cent previously.

TRADE IN FOREST PRODUCTS (EXCEPT BOOKS AND PRINTED MATTER)

Calendar Years	Exports		Imports		Favourable Balance of Trade
	Value	Per Cent of Total	Value	Per Cent of Total	
	\$		\$		\$
Average 1926-30.....	278,500,721	23.58	37,628,283	3.34	240,872,438
1931.....	184,641,523	30.50	21,380,003	3.40	163,261,520
1932.....	133,382,212	27.01	12,989,849	2.86	120,492,363
1933.....	130,785,302	24.59	10,442,173	2.60	120,343,129
1934.....	160,039,612	24.51	12,039,911	2.34	147,999,701

During the five years 1930-34, the value of forest-products exports was \$60,110,000 less than agricultural and vegetable products, but exceeded all mineral and chemical products by approximately \$34,460,000. The value of exports of non-ferrous metals, including all the gold, silver, copper, nickel, etc., was less than one-half the value of forest products. The favourable balance derived from forest products was greater than that from all agricultural and animal products and was sufficient to offset the large unfavourable balance in mineral and textile products.



AVERAGE ANNUAL TRADE OF CANADA BY MAIN GROUPS OF PRODUCTS  
Calendar Years 1930-34

Item	Exports of Canadian Products	Imports for Consumption	Balance of Trade	
			Favourable	Unfavourable
Wood, wood products and paper (except books and printed material)	171,468,500	17,999,598	153,468,902	.....
Agricultural and vegetable.....	231,579,410	124,232,215	107,347,195	.....
Animals and animal products.....	73,561,580	28,604,121	44,957,459	.....
Non-ferrous metals and their products.....	80,151,211	34,522,873	45,628,338	.....
Iron and its products.....	28,512,611	112,391,665	.....	83,879,054
Non-metallic minerals and their products.....	15,312,818	108,881,808	.....	93,568,991
Chemical and allied products.....	13,031,272	29,640,282	.....	16,609,010
Fibres and textiles.....	6,378,346	92,479,419	.....	86,101,073
Books and printed matter.....	778,730	11,471,579	.....	10,692,849
Miscellaneous commodities.....	13,181,040	40,151,426	.....	26,970,386
TOTAL.....	633,955,523	600,775,186	33,180,337	.....

TABLE VI.—AVERAGE ANNUAL EXPORTS AND IMPORTS  
Calendar Years 1929-33

—	Exports		Imports		Balance +	
	Value	Equivalent in Standing Timber	Value	Equivalent in Standing Timber	Value	Equivalent in Standing Timber
	\$	Million Cu. Ft.	\$	Million Cu. Ft.	\$	Million Cu. Ft.
Conifers.....	45,374,185	489	3,132,935	26	42,241,250	463
Broad-leaved.....	5,335,167	43	3,878,893	17	1,456,274	26
Total.....	50,709,352	532	7,011,828	43	43,697,524	489



TABLE VIA.—AVERAGE ANNUAL PRODUCTION, EXPORTS, IMPORTS AND HOME CONSUMPTION  
By Primary Products  
Calendar Years 1929-1933

Commodity	Unit of measure	PRODUCTION			EXPORTS			IMPORTS			HOME CONSUMPTION		
		Quantity	Equivalent in standing timber	Value	Quantity	Equivalent in standing timber	Value	Quantity	Equivalent in standing timber	Value	Quantity	Equivalent in standing timber	Value
			1000 cu. ft.	\$		1000 cu. ft.	\$		1000 cu. ft.	\$		1000 cu. ft.	\$
Lumber.....	M ft. B.M.	2,999,358	656,859	60,325,904	1,268,339	280,051	28,672,157	118,867	26,881	5,619,406	1,849,886	403,689	37,273,153
Lath.....	M Pcs.	364,415	9,985	1,079,745	406,222	11,130	1,418,936	6,764	185	28,306	*	*	*
Shingles.....	"	1,963,375	43,194	5,229,826	1,393,455	30,656	3,927,710	30,047	661	82,253	599,967	13,199	1,384,369
Exported logs.....	M ft. B.M.	256,458	56,164	2,896,241	256,458	56,164	2,896,241	17,844	3,908	299,254	17,844	3,908	299,254
Square timber.....	"	71,174	15,587	1,475,068	71,174	15,587	1,475,068	468	102	31,051	468	102	31,051
Pulpwood.....	Cords	5,305,683	620,765	53,117,560	984,289	115,162	9,162,582	50,742	5,937	407,406	4,372,136	511,540	44,362,384
Hewn railway ties.....	Number	5,487,808	65,854	3,527,581	286,445	3,437	192,418	153,042	1,837	121,413	5,354,405	64,253	3,456,576
Poles.....	"	753,302	9,793	3,768,705	513,445	6,675	2,053,542	39,984	520	196,142	279,841	3,638	1,911,305
Fence-posts.....	"	15,084,757	30,170	1,321,681	579,299	1,159	52,271	46,767	94	6,667	14,552,225	29,104	1,276,077
Round mining timber.....	Cu. ft.	4,979,692	6,474	904,766	.....	.....	.....	.....	.....	.....	4,979,692	6,474	904,766
Fence-rails.....	Number	5,208,122	15,624	405,068	.....	.....	.....	.....	.....	.....	5,208,122	15,624	405,068
Fuel-wood.....	Cords	9,429,805	895,831	38,311,451	32,018	3,042	177,312	4,962	471	17,766	9,402,749	893,261	38,151,905
Wood for distillation.....	"	41,559	5,112	330,151	.....	.....	.....	.....	.....	.....	41,559	5,112	330,151
Miscellaneous products.....	"	196,256	22,962	1,739,572	77,831	9,106	681,115	18,725	2,191	202,104	137,150	16,047	1,260,621
GRAND TOTAL.....	.....	.....	2,454,374	174,433,319	.....	532,169	50,709,352	.....	42,786	7,011,828	.....	1,965,951	131,046,680

\*A considerable quantity of lath was manufactured in small plants, or as a by-product in larger mills, and the production was not reported; hence exports appear greater than production.



LUMBER

The benefit of the Empire Trade Agreements was further exemplified in 1934, when the exports of lumber to British countries increased to 1,060 million feet board measure, valued at \$19,347,404, as compared with 653 million feet, valued at \$10,358,053, in 1933, and 342 million feet valued at \$5,959,078, in 1932. Though the increase was predominantly in the exports to the United Kingdom, gains were made in the trade with practically every part of the Empire. The trade with foreign countries other than the United States increased slightly, in spite of the general business depression and the trade barriers erected in many countries to restrict imports.

It is gratifying to note that the United Kingdom is securing a larger proportion of her lumber requirements from Canada. During 1926-30 only 5·2 per cent came from Canada, but in 1934 Canada supplied 17·5 per cent.

PERCENTAGE OF UNITED KINGDOM LUMBER IMPORTS FROM CANADA

Sawn Lumber	Av. 1926-30		1934	
Softwood, rough.....	4·9		17·2	
Planed and dressed.....	0·1		18·1	
Hardwood.....	13·0		19·9	
TOTAL.....	5·2		17·5	

The exports of lumber to the United States established a low record of 234 million feet in 1934, largely by reason of the import taxes imposed by the United States, but also on account of the decreased consumption in that country.

The consumption of lumber has been decreasing steadily in both Canada and the United States since the beginning of this century, not only in the amount used per capita, but in total volume as well. The visible consumption is computed by adding imports to production and subtracting exports. This includes, therefore, an unknown quantity of stock on hand, which in individual years may be a source of considerable error; during periods of five years or more, however, the surpluses are usually liquidated. The abnormally large stocks in Canada in 1930 to 1932, however, undoubtedly account for the larger apparent consumption during the last period, 1928-32.

APPROXIMATE AVERAGE ANNUAL CONSUMPTION OF SAWN LUMBER

5-Year Period	Canada		United States	
	Total	Per Capita	Total	Per Capita
	Million Ft. B.M.	B. Ft.	Million Ft. B.M.	B. Ft.
1908-12.....	2,750	395	42,212	460
1913-17.....	2,352	300	38,805	390
1918-22.....	2,157	250	32,764	305
1923-27.....	1,837	195	38,521	335
1928-32.....	2,146	210	25,624	210

The displacement of lumber by other materials, such as iron, cement, and cellulose products, is probably the principal, but not the only cause, for this falling off in the use of lumber. The reduction in size of the average house, the concentration of families in apartment houses in which little wood is used, the lengthening of the life of wooden structures through preservative treatment, and the development of more economical methods of construction have all contributed to the reduced per capita consumption.

Though it is possible by informing the public as to the technical qualities of wood to curb the substitution of other materials for certain purposes for which wood is not only cheaper but more serviceable, the trend is undoubtedly towards a still further reduction of the use of lumber on this continent.

EXPORTS OF PLANKS, BOARDS, AND SQUARE TIMBER  
By Importing Countries in Calendar Years

Importing Country	Average 1926-30		1931		1932		1933		1934	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	M ft. b.m.	\$	M ft. b.m.	\$	M ft. b.m.	\$	M ft. b.m.	\$	M ft. b.m.	\$
United Kingdom.....	199,453	6,961,113	132,159	3,649,342	195,171	3,986,742	486,555	8,197,350	861,193	16,266,405
Irish Free State.....			5,866	129,424	2,550	43,064	3,084	50,064	25,169	464,804
New Zealand.....	9,260	264,850	2,287	38,091	1,195	23,948	1,613	40,482	2,999	78,771
Australia.....	36,189	765,484	45,327	813,127	119,085	1,416,817	124,078	1,444,205	123,905	1,598,933
British South Africa.....	13,090	299,930	5,721	100,477	5,188	87,348	14,387	191,760	20,160	355,747
British West Indies.....			5,961	156,348	12,179	256,583	14,220	262,145	17,156	332,697
Other British Countries.....				115,350	7,084	144,546	9,278	172,047	9,562	250,047
Total British.....	*	*	197,321	5,002,159	342,452	5,959,078	653,215	10,358,053	1,060,144	19,347,404
United States.....	1,458,828	39,529,242	665,460	14,253,637	326,832	6,660,965	296,864	6,418,839	233,714	5,853,229
China.....	21,378	375,803	41,692	547,303	45,105	473,946	110,694	1,172,492	103,522	1,209,749
Japan.....	185,058	2,736,269	129,368	1,925,667	68,865	899,752	59,652	706,297	71,810	985,085
Other Foreign Countries.....					7,635	165,574	20,116	323,825	21,936	446,764
Total Foreign....	*	*	836,520	16,726,607	448,337	8,200,237	487,326	8,621,453	430,982	8,494,827
Other Countries (British or Foreign).....	66,299	2,950,468	*26,101	323,800						
GRAND TOTAL....	1,989,645	53,883,159	1,059,942	22,052,566	790,789	14,159,315	1,140,541	18,979,506	1,491,126	27,842,231

\* Small British and foreign importers not differentiated.

PULP AND PAPER

About 20 per cent of the wood-pulp and 80 per cent of the paper produced in Canada is exported. On the basis of value, 83·6 per cent of the exports of pulp and paper during 1929-33 went to the United States, 6·8 per cent to the United Kingdom, and the remainder mainly to Australia, Japan, the Argentine Republic, New Zealand, and South Africa.

VALUE OF EXPORTS OF PULP AND PAPER

	To United States	To United Kingdom	To All Countries
	\$	\$	\$
1926-30 Average.....	156,921,807	9,637,058	183,754,861
1931.....	118,808,762	7,863,278	141,170,685
1932.....	87,656,019	6,373,199	105,253,603
1933.....	77,689,200	6,206,741	95,750,769
1934.....	88,684,933	7,071,600	112,653,565

Though Canada exports only about 20 per cent of the wood-pulp manufactured, she ranks fourth among the pulp-exporting countries of the world, being surpassed only by Sweden, Finland, and Norway.

WOOD-PULP PRODUCTION AND EXPORTS, 1929 TO 1933

Year	Production		
	Mechanical	Chemical	Total*
	Tons	Tons	Tons
1929.....	2,420,774	1,501,273	4,021,229
1930.....	2,283,130	1,265,057	3,619,345
1931.....	2,016,480	1,086,735	3,167,960
1932.....	1,696,021	913,438	2,663,248
1933.....	1,859,049	1,120,513	2,979,562
Average.....	2,055,071	1,177,403	3,290,269

\* Includes some unspecified pulp.

	Exports		
	Mechanical	Chemical	Total†
	Tons	Tons	Tons
1929.....	209,332	585,108	830,848
1930.....	208,758	527,800	760,220
1931.....	165,098	443,903	622,537
1932.....	116,229	328,533	452,293
1933.....	132,152	495,773	608,510
Average.....	166,314	469,023	654,882

† Includes unspecified screenings.

The principal product of the industry is newsprint, 92 per cent of which is exported.

NEWSPRINT

Year	Production	Exports
	Tons	Tons
1929.....	2,729,000	2,515,000
1930.....	2,504,000	2,333,000
1931.....	2,221,000	2,008,000
1932.....	1,915,000	1,777,000
1933.....	2,017,000	1,838,000
Average.....	2,277,200	2,094,200



TABLE VII A—PRODUCTION, EXPORTS, IMPORTS, AND HOME CONSUMPTION OF FOREST PRODUCTS  
Average, 1926-30, Calendar Years

Product and Unit of Measure	Production			Exports			Imports			Home Consumption		
	Quantity	Equivalent in standing timber	Value	Quantity	Equivalent in standing timber	Value	Quantity	Equivalent in standing timber	Value	Quantity	Equivalent in standing timber	Value
		1000 cu. ft.	\$		1000 cu. ft.	\$		1000 cu. ft.	\$		1000 cu. ft.	\$
<i>Unmanufactured and partly manufactured wood—</i>												
Lumber.....M ft. b.m.	4,270,367	935,210	100,646,185	1,833,133	401,456	50,001,877	200,278	43,861	10,057,294	2,637,512	577,615	60,101,602
Lath.....M pos.	1,014,686	36,833	4,189,683	1,158,318	42,147	5,563,116	9,332	338	49,268			
Shingles.....M pos.	2,724,989	59,949	8,874,270	1,911,740	42,234	6,826,006	60,945	1,341	176,904	866,154	19,056	2,224,568
Square timber.....M ft. b.m.	310,346	67,963	4,322,995	310,346	67,963	4,322,995	25,481	5,580	525,103	25,481	5,580	525,103
Pulpwood (exported).....(ords)	154,512	33,838	3,281,282	154,512	33,838	3,281,282	852	187	34,984	32,877	3,847	285,338
Hewn railway ties.....Number	1,418,247	165,935	14,393,150	1,418,247	165,935	14,393,150	683,735	8,205	705,223	8,109,507	97,314	5,645,685
Poles....." "	8,661,884	103,942	5,935,260	1,236,062	14,833	994,738	52,190	678	292,286	321,329	4,177	1,989,387
Fence-posts....." "	1,103,131	14,419	5,224,421	839,992	10,920	3,527,320	141,091	282	17,723	14,617,741	29,235	1,430,790
Piling....." "	15,084,105	30,168	1,473,290	607,515	1,215	60,223						
Round timber.....Lin. feet	7,604,180	1,083	1,224,143	3,303,000	1,083	294,169						
Fence-rails.....Cu. ft.	3,305,000	10,781	487,432	27,116	2,576	159,246						
Fuelwood.....Number	5,390,303	913,066	41,466,034									
Wood for distillation.....Cords	9,611,223	6,006	444,621	(a) 4,712	725	197,864	(a) 22,263	3,425	935,719	(a) 33,877	5,212	1,424,030
Veneer....." "	49,318	2,512	656,175	149,073	17,442	2,486,063	36,669	4,290	317,090			317,090
Bamboo cane, etc.....M sq. ft.	16,326	27,599	2,707,420						658,907			880,264
Miscellaneous Products.....(ords)	233,765									121,361	14,447	
Total.....		2,419,252	195,651,530		802,370	92,738,649		72,635	14,083,070		1,694,493	116,995,951
<i>Manufactured wood—</i>												
Furniture, caskets, etc.....			40,846,668			366,031			2,934,344			43,414,981
Wood turned and carved.....			1,317,015			88,011			912,542			2,141,546
Sash and door moldings.....			47,431,589			111,775			628,568			47,948,382
Cooperage.....			3,132,595			190,088			1,295,832			4,238,339
Cork, manufactures of.....									1,013,365			1,013,365
Miscellaneous.....			4,024,054			1,251,304			2,973,991			5,746,911
Total.....M ft. b.m.	(b) 193,503	42,377	96,751,921	(b) 4,014	879	2,007,209	(b) 19,517	4,374	9,758,642	(b) 209,007	45,872	104,503,524
<i>Wood-pulp—</i>												
Sulphite, bleached.....Tons	293,778	66,038	21,323,645	238,534	53,618	18,091,152	528	119	234,076	55,772	12,539	3,466,568
Sulphate, unbleached....." "	794,507	178,592	35,041,886	210,104	47,228	10,863,462	18,758	4,216	752,377	603,161	135,580	24,930,801
Sulphate (Kraft)....." "	242,783	48,598	13,252,441	144,202	28,865	8,648,170	99,987	208	51,587	99,568	19,941	4,655,858
Groundwood....." "	2,130,999	248,953	47,291,849	252,934	29,549	7,337,442	1,213	142	47,750	1,879,278	219,546	40,002,157
Screenings....." "	82,705	9,662	1,093,100	22,121	2,584	409,046				60,584	7,078	684,054
Miscellaneous....." "	6,706	783	431,077	1,037	121	73,917				5,669	662	357,160
Total.....	3,551,478	552,626	118,433,998	868,932	161,965	45,423,190	21,486	4,865	1,085,790	2,704,032	395,346	74,096,598
<i>Paper (except printed matter)—</i>												
Newsprint and printing.....Tons	2,314,671	331,479	136,341,249	2,133,689	305,561	132,130,559	6,749	967	1,149,419	187,731	26,885	5,360,109
Writing and stationery....." "	29,794	4,267	6,534,023	456	65	74,468	2,907	416	553,440	32,245	4,618	7,012,995
Packing and wrapping....." "	96,225	13,780	9,238,109	16,142	2,312	1,894,058	8,738	1,251	2,158,954	88,821	12,719	9,503,005
Board....." "	198,661	28,450	10,840,253	21,097	3,021	2,545,929	25,269	3,619	1,901,220	202,833	29,048	10,195,544
Wall and hanging....." "	7,272	334	554,821	1,450	207	416,491	1,705	244	522,391	7,527	371	660,721
Building....." "	28,936	4,144	1,905,199	2,470	354	148,247	4,411	632	272,657	30,877	4,422	2,029,609
Tissue, etc....." "	3,518	504	706,450				3,195	457	948,873	6,713	961	1,655,323
Miscellaneous....." "	62,516	8,952	9,480,773	2,666	382	1,121,919	16,040	2,297	5,193,827	75,890	10,867	13,552,681
Total.....	2,741,593	391,910	175,600,877	2,177,970	311,902	138,331,671	69,014	9,883	12,700,781	632,637	89,891	49,969,987
Net Totals.....		(c) 2,973,127	(d) 482,675,597		1,277,116	278,500,719		91,577	37,628,283		(e) 1,787,588	(f) 240,717,370
(a) Estimated.												
(\$66,000,000), pulp exported and paper produced.												
manufacture (\$66,000,000), excess of imports of manufactured wood and paper consumed.												
(b) Estimated at \$500 per 1000 ft. b.m.												
(c) Includes unmanufactured wood, pulp exported and paper produced.												
(d) Includes unmanufactured wood, value added by manufacture												
(e) Includes unmanufactured wood, value added by manufacture												
(f) Includes unmanufactured wood, value added by manufacture												

Canada manufactures more newsprint than any other country, making about one-third of the world production, and exports more than all other countries combined.

WORLD PRODUCTION AND EXPORTS OF NEWSPRINT, AVERAGE 1929 TO 1933

	Production	Exports
	Tons	Tons
World.....	6,732,400	3,376,021
Canada.....	2,277,200	2,094,223
United States.....	1,156,800	11,633
Great Britain.....	716,800	89,161
Germany.....	523,000	187,434
France.....	260,600	.....
Japan.....	281,000	57,658
Newfoundland.....	276,200	263,747
Sweden.....	260,600	203,671
Finland.....	244,000	215,731
Norway.....	172,400	160,778
All other countries.....	563,800	91,995

B.—IMPORTS

Canada’s imports of forest products normally amount in value to only about 14 per cent of the value of the exports and 16 per cent of the home consumption. They consist chiefly of woods which are not grown in Canada or of which there is an insufficient supply, such as tropical woods and oak, of furniture and other manufactured wood products, and of paper of kinds not largely manufactured by domestic mills.

During the five years 1930-34, the value of the imports of wood, wood products, and paper, exclusive of books and printed matter, averaged approximately \$18,000,000, of which 81·4 per cent came from the United States, 8·7 per cent from the United Kingdom, and 9·9 per cent from all other countries.

14—Summary and Outlook

A—HOME CONSUMPTION OF HOME-GROWN AND IMPORTED TIMBER COMPARED WITH THE TOTAL INCREMENT

The trade in forest products has been so restricted during the last five years that it is considered advisable, in order to present a picture of the normal demands on the forest and the disposition of the forest products, to use the data for the years 1926-30. Table VIIA shows the average annual production, exports, imports, and visible consumption of all the principal products in the form in which they are exported, imported or marketed in Canada, during those years. The annual utilization of Canadian wood was then the equivalent of 2,973 million cubic feet of standing timber; the exports represented 1,277 million cubic feet, and the imports 92 million, so that a domestic consumption of the equivalent of 1,788 million cubic feet was indicated.

As pointed out in Section 11, the annual increment has not been determined, but there is no doubt that under proper care and management the 512,500,000 acres of accessible and producing forests are capable of producing from two to four times the amount now used.

TABLE VII.—SUMMARY STATEMENT  
(Expressed as Standing Timber)

Average Calendar Years 1929-33

	Utiliz- ation (Table IV, Cols. 3 and 7)	Exports (Table VI, Col. 3)	Con- sumption of home- grown timber (Col. 1 minus Col. 2)	Imports (Table VI, Col. 6)	Total con- sumption of home and imported timber (Col. 3, plus Col. 4)	Net increment (Table III, Cols. 5 and 10)	Balance plus (+) or minus (—) (Col. 6, minus Col. 5)
	(1) Million cu. ft.	(2) Million cu. ft.	(3) Million cu. ft.	(4) Million cu. ft.	(5) Million cu. ft.	(6) Million cu. ft.	(7) Million cu. ft.
Conifers.....	1,686	489	1,197	26	1,223	.....	.....
Broad-leaved.....	769	43	726	17	743	.....	.....
TOTAL.....	2,455	532	1,923	43	1,966	.....	.....



## B.—PROBABLE DURATION OF SUPPLIES

The accessible timber of merchantable size is estimated at 170,141 million cubic feet, with an additional 103,426 million cubic feet which though now classed as inaccessible, may, in part at least, become accessible with the extension of transportation facilities and changes in the market conditions. The development of the pulp and paper industry has greatly extended the merchantability of certain species and classes of timber, resulting in the opening up of large areas which previously had been deemed unprofitable from the sawtimber point of view.

Only about one-quarter of the merchantable timber can be considered virgin in the sense that it has reached that stage of maturity where decay equals increment.

On the whole, the principal species of both softwoods and hardwoods reproduce well after cutting and even after one fire, but repeated fires result in their elimination. Artificial reforestation is necessary only where natural reproduction is deficient or where it is desired to introduce species not already on the ground.

If a broad national view of the forest situation be taken it will be seen that there has been a very great improvement during the last decade as compared with preceding periods when the amount of timber destroyed by fire exceeded the amount used. Depletion due to fire has been reduced to less than ten per cent of the cut. Nevertheless, the average annual loss through fire is still some 263 million cubic feet—obviously a condition which calls for even greater effort in fire control.

The loss through insects is becoming a relatively more prominent factor in forest depletion and is difficult to combat. At present the spruce sawfly is perhaps the most destructive forest insect, and its control is being actively attempted by the introduction of parasites from Europe.

Until more complete inventories of the forest resources are made and the increment in the various types and regions is known, it will be impossible to determine the productive capacity of the forests. From the information with respect to forests already available, it is abundantly clear that the more immediate problem facing Canada lies not so much in the averting of a complete exhaustion, for such a condition is not imminent. Rather, the problem lies in the substantial improvement in all phases of forest protection, more accurate and more complete data regarding the content of, and growth in, her forests, and, finally, in the adoption of less exhaustive methods of extraction and more provident use of the products of the forests—all to the end that the forest industries of the Dominion may the better, more permanently, and more economically serve the needs of her people in both domestic and export trade.

## C.—STEPS WHICH SHOULD BE TAKEN TO PROTECT AND DEVELOP THE FOREST

In Canada the great natural resource is the land, and the optimum results can be secured only through carefully planned use of this resource. Owing to the large percentage of land in the Dominion comprising soils suitable only for timber production, obviously the application of forestry principles is a national necessity.

This is the more true because large areas of settlement in forested districts can only become and remain prosperous if there is proper correlation between agriculture and forestry. Individual farm holdings in the northern areas are in many sections not adequate to provide a livelihood unless, added to the products of the farm, remunerative employment exists in the neighbouring forests. Natural conditions in the northern settlements are such that forest employment comes normally in the winter and is therefore complementary to farm work, which is concentrated during the summer season.

Forestry occupations, to be of lasting value, must be continuous, which is to say that the forest resource must be managed on a sustained-yield basis. Continuity is naturally dependent on opportunity for a profitable utilization of the products of the forest. This means stable and remunerative markets. A national forest policy adequate to meet Canadian needs must, therefore, concern itself with the provision of satisfactory markets for the important products and by-products of the forest, as well as with the proper handling of the forest resource itself. This condition also emphasizes the need for an intimate co-ordination between silvicultural and utilization research.

The economic phases of the problem are essentially national in character, and must include detailed attention by the federal authority in close co-operation with the provinces and industry.

On the forestry side, a national forest policy must provide for integration between the productive capacity of industry and the timber supply, both that presently available and that potentially possible under proper management. Under existing conditions, sustained yield can be obtained only through concerted action of the Dominion and provincial authorities whereby production costs, so far as these are affected by forestry requirements, may be equalized as between the different forest regions.

The situation existing in Canada, whereby each individual province exercises sovereign control over its forest estate, presents difficulties. Experience of older countries demonstrates that industry of itself cannot be expected to develop successfully a sustained-yield program. In the final analysis, certain fundamental principles of management must be imposed on industry if that objective is to be attained. Obviously, there should be no compromise between forest devastation, as now practised in many parts of the country, and sustained yield. It is, therefore, evident that there must be developed and enforced a much greater degree of governmental control with respect to both private and publicly owned forest lands.



Many preliminary steps must be taken and many additional data obtained before forest management can be made effective in Canada. In the first place, a stock-taking, including not only the existing timber supplies but the growing stock, must be made. This will make it possible to strike a balance between increment and depletion from all causes. Secondly, fire protection must be developed to an extent which will make the more valuable timberlands at least an insurable resource. Finally, silvicultural research and experiment must develop proper methods of handling existing timber stands in order to obtain species or mixtures which will provide the highest quality and financial returns in the light of market conditions. Along with this, there must be utilization research to improve the market qualities of existing forest products, to provide a market for species for which little use has yet been found, for thinnings, and for material at present wasted in logging.

Coincidentally with the above, it seems obvious that the state must assume much greater responsibility in meeting the carrying charges of future timber supplies. If the forest estate is to be permanently conserved for the public benefit, there must be a great increase in public management of forest lands. In the past the procedure in some parts of Canada has been to dedicate to forestry only such lands as were considered unprofitable by industry. There is need for a fundamental revision of this policy, because, if sustained yield is to be developed on an economic basis, there must be concentration of protection and administration on those areas which provide the best growing conditions and which comprise the most accessible sites for future management. The trend should be from first-class forest soils upwards to sub-marginal agricultural soils, in contradistinction to the past practice of reserving largely lands sub-marginal even to timber production, whose principal value is for watershed protection, game preservation, recreation, or other secondary uses. On the other hand, if the state is to carry a large proportion of timber reserves, industry must be given adequate assurance that state management of such holdings will be efficient and adequate to ensure a continuous supply of raw material.

The introduction of intensive forestry methods into woods operations may in some cases mean increased costs of extraction, although it has been found that the additional facilities obtained in logging through brush disposal and the reduction in losses by not taking small-sized timber may largely offset these. Any such increased costs may be equalized in part by the assumption by the state in a large measure of carrying charges for future timber supplies.

From the above it will be seen that under Canadian conditions the essential steps to protect and develop the forests involve, on the side of industry, a basic reorientation including greater state control over extraction methods, planned use of raw materials by specified industries, and possibly some increases in production costs. On the other hand, the state should provide greater assistance in marketing, assume large obligations in the dedication and protection of timberlands, and develop through research and experiment a technique to ensure sustained yield of maximum quality and value of timber products. These readjustments, fundamental though they be, are essential to the economic well-being of the Dominion. It is obvious that the objectives can only be attained over a term of years through concerted action of the Dominion and provincial authorities following joint conferences, together with industry to smooth out difficulties as they arise.

Finally, it may be pointed out that the major difficulties in the situation are on the economic side. By this it is meant that the solution of the silvicultural problems may be expected to proceed more easily and faster than the attainment of the basic reorientation of industry which a planned use of the forestry resource will require. Nevertheless, the ultimate results of such a program should provide such benefits from the standpoint of public welfare through stabilization of population and permanence of prosperity as to justify every effort in that direction.



## APPENDIX

## DOMINION FOREST SERVICE PUBLICATIONS AVAILABLE FOR DISTRIBUTION

ANNUAL REPORTS of the Director of Forestry, 1914-15-17-18-19-21-22-24-25-26-27-28-29-30-31-32-33-34-35.

- BULLETIN 49 Treated Wood-block Paving.  
 " 59 Canadian Woods for Structural Timbers.  
 " 61 Native Trees of Canada.  
 " 66 Utilization of Waste Sulphite Liquor.  
 " 69 The Care of the Woodlot.  
 " 71 Canadian Sitka Spruce: its mechanical and physical properties.  
 " 73 Tree-repairing.  
 " 74 Distillation of Hardwoods in Canada.  
 " 76 Pulping Qualities of Fire-killed Wood.  
 " 78 Some Commercial Softwoods of British Columbia.  
 " 79 Taper as a Factor in the Measurement of Standing Timber.  
 " 80 British Columbia Softwoods: their Decays and Natural Defects.  
 " 81 The Identification of Woods commonly used in Canada.  
 " 82 The Mechanical Properties of Canadian Woods, together with their related physical properties.  
 " 83 Sawmill Waste and its Utilization in British Columbia.  
 " 84 The Cellulose-water Relationship in Paper-making.  
 " 85 The Forests of Manitoba.  
 " 86 Kiln-drying British Columbia Lumber.  
 " 87 Investigation of Physico-chemical Factors which influence Sulphite Cooking.
- CIRCULAR 16 Preservative Treatment of Fence-posts.  
 " 19 Canadian Softwoods.  
 " 21 Tests of Green-cut Western Cedar Poles.  
 " 22 Report on Tests of the Relative Strength of Green-cut and Fire-killed Western Red Cedar Pole Timber.  
 " 23 Absorption of Moisture by Kiln-dried Lumber.  
 " 24 Strength of Reinforced and Unreinforced Butter and Cheese Boxes.  
 " 25 List of Forest Service Publications.  
 " 26 Creosote Treatment of Douglas Fir.  
 " 27 Stain and Decay in Lumber-seasoning Yards.  
 " 28 Strength Tests of Creosoted Douglas Fir Beams.  
 " 29 Strength Tests of Creosoted Douglas Fir Railway Ties.  
 " 30 The Rate of Growth and Density of the Wood of White Spruce.  
 " 31 The Strength of Telephone Poles.  
 " 32 Changes in Moisture Content of Kiln-dried Lumber when Shipped by Rail.  
 " 33 Effect of Moisture Content and Storage on the Heating Value of Sawdust.  
 " 34 Strength and Spike-retention Properties of Jack Pine Ties affected with Red Stain and Red Rot.  
 " 35 Effect of Seasoning on the Buoyancy of Logs.  
 " 36 Leaching Tests on Water-soluble Wood Preservatives.  
 " 37 Red Stain in Jack Pine: a comparative study of the effect of *Trametes Pini* and a second red-staining fungus on the strength of jack pine.  
 " 38 The Effect of Kiln Temperatures and Air-seasoning on Ambrosia Insects (Pinworms).  
 " 39 The Design of Wooden Boxes.  
 " 40 Open-Tank Treatment of Red Pine Lumber.  
 " 41 Western Red Cedar: Significance of its Heartwood Colorations.  
 " 42 The Strength of Lodgepole Pine Telephone Poles.  
 " 43 The Determination of Arsenic in Wood.

TREE PAMPHLETS: 1, White Pine; 2, White Spruce; 3, Douglas Fir; 4, Hemlock (Eastern); 5, Western Hemlock; 6, Red Pine; 7, Jack Pine; 8, Lodgepole Pine; 9, Balsam Fir; 10, Cedar (Eastern); 11, Western Cedar; 12, Sitka Spruce; 13, Western Yellow Pine; 14, Sugar Maple.

STORIES and Plays for Children—

Betty in Dreamland.  
 The Woodland Fairy.

FORESTRY LESSONS.

- FORESTRY TOPIC 2 Forest Fire Protection in Canada.  
 " " 4 The Need of a Definite Forestry Policy.  
 " " 6 The Christmas Tree Trade in Canada.

MANUAL of Methods of Communication adapted to Forest Protection.

FOREST Research Manual.

FORM-CLASS Volume Tables.

PAPERS presented before the Third British Empire Forestry Conference, held in Australia and New Zealand, 1928—

- Tree Planting in the Prairie Provinces of Canada.  
 Forest Fire Protection in Canada: Progress since 1923.  
 Silvicultural Research in Canada.  
 State Forests in Canada.  
 Softwood Resources of Canada.

PROCEEDINGS and Resolutions of the 1923 British Empire Forestry Conference.

THE FOREST Products Laboratories of Canada.

CANADIAN Export Timbers: their properties and uses.

CANADIAN Woods: their Properties and Uses.

THE FORESTS of Canada.

FOREST FACTS.





